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Pulley Drilling and Tapping Machine.

The "good old way" of drilling and tapping the hubs of pulleys for set-screws was to block up the pulley on the table of a drill press, and drill down through the rim and into the hub with a long forged drill, whose tendency to spring if crowded and to displace the pulley constituted one of the most annoying features of the job.

Our illustration is of a machine which is intended to do this work in a scientific way—holding the pulley securely in its proper position, drilling it with a twist drill without drilling through the rim, and then tapping the hole by power without moving the pulley from its position.

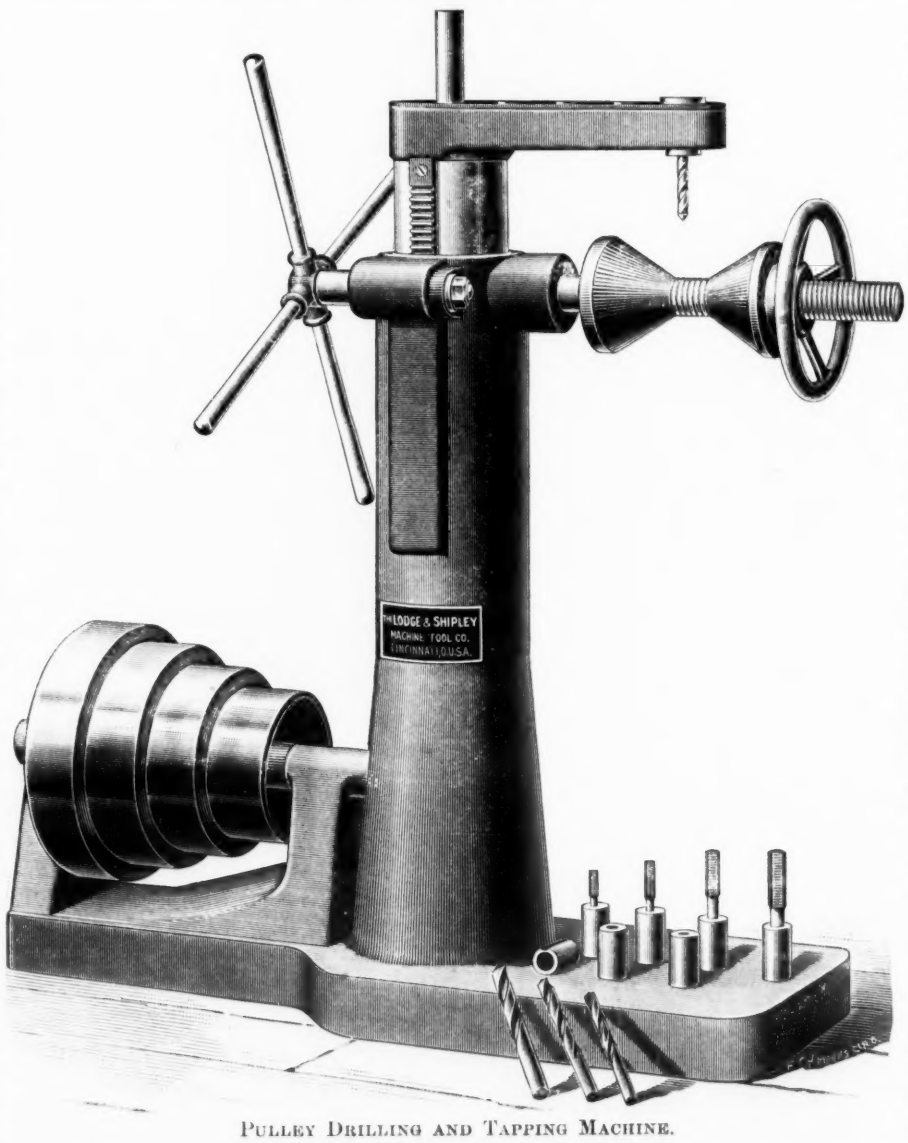
The hub of the pulley is put over the horizontal screw shown, and is centered by the opposing cones, which enter the bore of the pulley, and are clamped tight by the hand-wheel.

The projecting arm above has within it a train of gears, which are driven from the upright shaft which passes up through the center of the column, and these gears drive the short quills or collets which hold the drills and taps, these being provided with keys by which they are driven when put in place, while they drive the drills and taps by means of squared holes at their upper ends, which receive the flats of the ordinary commercial drills and the squares of the regular machinists' hand taps. Small set-screws hold the tools up in place. Sets of these are furnished with the machine, consisting of $\frac{1}{2}''$, $\frac{5}{8}''$, $\frac{3}{4}''$ and $1''$.

The drill arm readily goes between the rim and hub of all pulleys down to 10″ diameter, and any width of face up to 20′, while the range of the machine admits pulleys up to 5 feet 6″ diameter.

The pilot wheel controls the feed, and the sliding column is nicely balanced, so that it is quite sensitive.

A friction countershaft with reverse motion is furnished with the machine, which weighs 800 pounds, and is made by the Lodge & Shipley Machine Tool Co., Cincinnati, Ohio.



PULLEY DRILLING AND TAPPING MACHINE.

Machine Tool Work.

BY W. D. FORBES.

In a recent tour of old haunts the writer was made aware that the mechanical world, in the language of the day, "has got a move on it"; and this question strongly presented itself to his mind: Is the art of removing superfluous metal at its highest development?

The production of a single article under the conditions of little regard to time, dimensions or cost, and the production of hundreds of articles with some regard to these, is recognized by all as totally different; yet both demand metal to be removed. What is most important to consider is, whether our present lathes, planers and millers are doing this as rapidly as they can be made to do, considering present designs.

Let us illustrate. A certain article of brass was made in large numbers where the writer was in charge; the price paid for it was 12 cents; the demand became so great that orders could not be filled—no more room could be given in which to place tools of the usual design, so the writer made drawings and built a special tool, and was able to turn out the article for six cents. This was very satisfactory, and for some time no further improvement was looked for. On the tour above referred to the writer went to look at this machine; it was in the scrap heap, and in its place was a tool of at least five times its weight and eight to ten times its power, on which the articles were turned out at a *cost of labor of seventy-one cents a hundred.* The wages made by the operator were almost 25 per cent. more than at the six-cent price.

The gain seemed due to the better position of cutting tools, greater power and solidity, and not at all due to the *form* of cutting tool; and it is the opinion of the writer that by new forms of tools this machine could be made to greatly reduce the cost.

It is generally argued that the limit of speed in cutting is reached when the cutting edge gives out, either by breaking or failing to hold its edge, or when the work itself is such that it will not stand heavy cuts. This may be true, and it seems that with present well-known cutting tools we can hope for no better results than are now obtained by first-class men or the best designed tools. Yet it is the inference from the above statement concerning reduction in cost that we are constantly doing more and more work; and great as has been the gain in speed, we must either make the absurd statement that we have arrived at the highest state of the art, and, further, there is nothing possible, or we must admit room for improvement, and in the admission look for the paths which seem most likely to lead to this end.

In the writer's opinion there is more than one path, but the most promising one lies in the direction of improved forms of cutting edges, and then in their positions; and to those who desire to advance, experiments can be made at less expense on these lines than on any other, and with better possibility of commercial gain, which is the aim of all mechanical enterprises. The strength of machine tools is another path which it will pay to travel, not that what we now have is so bad as is the idea of additional strength one which demands additional metal, but the great enemy of rapid and perfect work, vibration, can be better counteracted by a distribution of metal than by simple mass. To illustrate this; all of us who have run lathes have resorted to the weight of a monkey wrench on the back end of the tool to stop vibration, and with good results, and have found the position of the wrench of more importance than its weight; and the writer has often found the chatter in boring could be almost if not quite stopped by shifting the foot-stock along the Vs. Of course, both actions produce results in accordance with known, but neglected, physical laws, and when these laws are properly and generally understood and applied by the machine tool builders, it is the opinion of the writer the gain in work before referred to will be bettered many times over.

Boilers and Fire Service at Chicago.

The damage to the buildings of the Fair caused by the thaw of ten days ago was not nearly so heavy as reported at the time by the daily papers. Machinery Hall was injured very little. The repairing is a matter of small moment, as the wood covering of the roof was the only thing damaged to any extent, and this in but three or four places. No more trouble is expected, as the great part of the snow has melted from the roofs.

The court has upheld the Babcock & Wilcox Co. in its injunction against the Stirling Boiler Co., preventing the latter from placing their boilers in the west end of the boiler house, next to the Babcock & Wilcox boilers. The Stirling people have appealed the case. Meanwhile the time is passing rapidly, and the space still remains vacant.

It will be remembered that in the description of the pumping station at the Fair, equipped by Henry R. Worthington, in the AMERICAN MACHINIST of December 15th last, mention was made of two small pumps, which were intended for fire service only. These pumps have a special system of piping of their own to supply water at a very high pressure to the high buildings in case of fire. They are 16″x9½″ x10″ duplex plunger, and connect direct with an 8′ main. This main runs north and east to the west foundation of the central arch of the Manufactures building. Thence a 7″ pipe follows the curve of the great arch to and up each side of the middle of the lantern roof. Thence branches lead which encircle the entire lantern. A platform extends around the lantern roof; on this platform are located thirty-two hose reels, each supplied with a liberal length of 2½-inch hose pipe.

Two 4-inch branches lead from the 8-inch main pipe line—one to the Agricultural building, where four reels are placed outside the lower part of the dome, and one to the Administration building, where there are four hose reels within the dome. It is very probable that a branch will be run to the Government building to protect its very high dome.

Extra heavy wrought-iron pipe and cast-iron fittings have been used throughout. Every piece was tested to 500 pounds hydraulic pressure per square inch.

These pumps are guaranteed to furnish water at 200 pounds working pressure. It is not expected, however, that more than 175 pounds will be required of them, should it ever be necessary to use this system for fire purposes.

The highest point to be reached is the top of the Administration dome, 270 feet above the ground; the reels are about 200 feet above grade, while on the Manufactures the reels are practically at the very top of the building, 200 feet from the floor.

The above system is only auxiliary to the regular fire protection system, which is complete in every detail. The buildings are built so largely of wood that the under-

writers have wisely required that every possible precaution be taken against damage by fire.

Jackson Park, February 8th, 1893.

A New Friction Clutch Pulley.

We present with this illustrations of a new friction clutch pulley, which is especially adapted to meet a demand which has arisen in some cases for a clutch pulley capable of working satisfactorily at considerably higher speeds than such pulleys have been commonly run. The difficulty experienced at these high speeds is in the fact that centrifugal force tends to throw the friction shoes outward against the rim of the pulley, and thus to throw it into action, especially where it is used as a driving pulley, in which case when not in action the rim stands still, and the other parts of the mechanism revolve.

The difficulty referred to is overcome in this pulley by the simple expedient of so balancing the friction segment as that it has no tendency to fly outward to the rim at any speed. The segment is thrown out by the action of toggle joints, which are moved by a sliding collar at the hub of the pulley, and all necessary adjustments are provided for, both in the levers of the toggle joints, and in the arms which support the segments. Our illustrations show two different styles of the pulley—one in which the friction rim is independent of and smaller than the belt rim.

Quite a number of these pulleys have been constructed, and are in use for such purposes as driving dynamos, rolling-mills, compressors in cold-storage establishments, and are working satisfactorily at high speeds. Some of these are 6 feet diameter, 13" face.

The manufacturers are Volney W. Mason & Co., Providence, R. I.

Cost of Machine Work.

By Frank G. Hobart.

To most readers the method to be described will present few features that are new. It was the outgrowth of several articles on the subject, which have appeared in the American Machinist, together with the writer's need for a simple, accurate and cheap way of getting at the cost of work in a shop employing about seventy-five men building engines and transmission machinery.

Time slips printed like this specimen [reduced to about half size] were distributed to the men. All work was done on orders.

NAME.		NAME.		NAME.	
DATE.		DATE.		DATE.	
HOURS.		HOURS.		HOURS.	
WORK.		WORK.		WORK.	
PIECE SYMBOL.		PIECE SYMBOL.		PIECE SYMBOL.	
ORDER NO.		ORDER NO.		ORDER NO.	

Each order came from the office on a printed form giving the number of the order, and all specifications necessary for its completion and shipment. For much of the work these specifications were re-written on tags, which were sent to the foundry and tied to the castings before they reached the shop.

The time slip, it will be seen, is divided by horizontal lines into three parts, each complete with its printed headings. At the close of the day the slips were filled out by the men, one part being used for each job he had worked on. In case he had worked on more than three jobs during the day, more than one slip was used, the object being to provide one of these parts for every job that he had worked on. Should the work not be on orders, but on tools, repairs, etc., under "order number" was put down such headings as it was desired to find the cost of. Under "work" only the number of tool was given for machine work, and "fitting," "erecting," "crating," etc., for other work, whatever it might be. Under "name" could be put the man's number, if preferred. In this case the entries would consist almost entirely of figures.

Each morning these slips were collected by the time-keeper, and the entries examined and checked by the foreman under whose direction the work was done. The pay-roll time-book was then made up from the slips, no time being allowed except it be represented by a time slip. It was the time-keeper's duty to separate each slip into the three parts by cutting along the horizontal lines. Of course a number could be cut at once. These separated parts were then filed away in envelopes. One envelope was assigned to each shop order, and the number marked in the upper right-hand corner. Work not done on orders, such as repairs, tools, etc., could be filed under such heads, and the cost determined for each week or month.

When it was desired to check the accuracy of the reports, the total labor cost was figured from the slips for a month, and the result compared with the pay-roll.

These envelopes also formed a convenient receptacle for all information pertaining to the orders which it was desired to preserve, such as weights of castings and forgings, bills for material or articles purchased specially for the order.

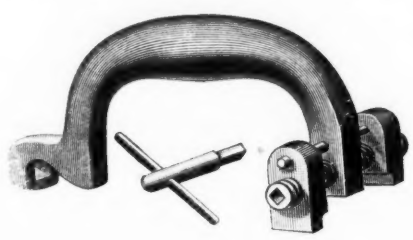
When the order was completed, we had in a form easily referred to, total labor, time and cost, full details as to time, cost, date, workman, and the particular machine tool used for each operation. The only writing done was the original entry by the workman, certified to by the foreman.

Repairs of a Printing Press.

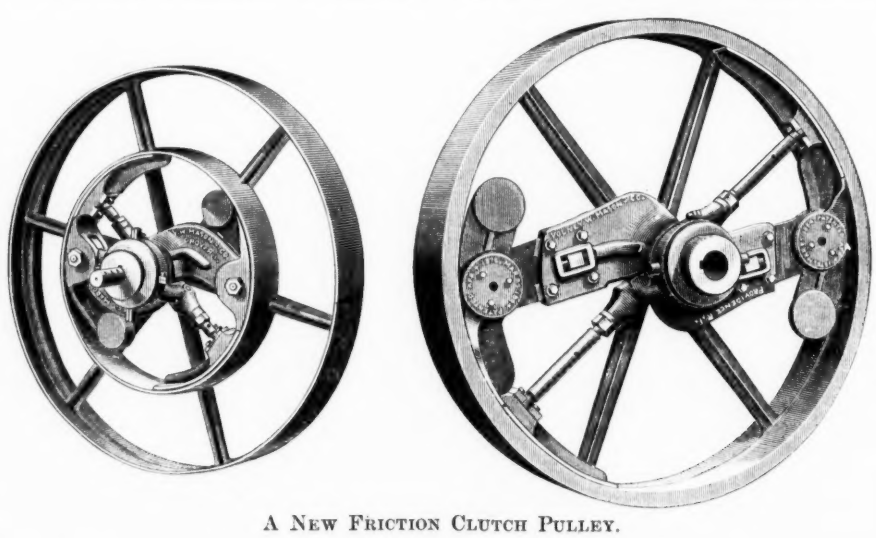
We happened on a neat and ingenious expedient recently. The cylinder of a large printing press, mounted on cast iron gudgeons, following the laws that govern that metal, broke loose from its moorings and dropped down on the bed. Mr. W. A. Doble, the manager of the A. Doble Company, was called in to see the press, and instead of wrecking it to get at the cylinder, he sent up from the works an angle plate to be bolted to the side of the press frame, the foot-stock of a small lathe to be set on the angle plate, placed the projecting boss of the cylinder in an improvised steady rest, started the press, drilled out and bored the head to receive a steel gudgeon. The whole operation, including the new gudgeon, cost less than it would to have taken the cylinder out of the press, besides the work was absolutely true, and better done than if the cylinder had been removed for the purpose. The cast-iron gudgeon does not admit of comment.—*Industry.*

Surface File Holder.

We illustrate with this an appliance which is intended to take the place of the well-known surface file holder in common use, in which the tang of the file is wedged into an opening at the back, and the body of the



file is not held at all. In the tool we now show, the tang of the file is first passed through the opening at the back, and the edges of the file are then clamped firmly by the two clamps shown at either side, which are moved by a right and left-hand screw turned by the key-wrench shown. As the tang of the file is somewhat sprung in putting it in place, it is firmly held. A few of these kept in the tool room, or where they are most wanted, ought to prove a good investment in most machine shops. They are manufactured by Charles J. Prankard, 471 9th street, Troy, N. Y.



A New Friction Clutch Pulley.

Cincinnati Manufacturers' Needs.

The *Commercial Gazette* of Cincinnati has been interviewing the manufacturers of that city on the subject of what the city needs in order to further develop its manufacturing interests.

The concensus of opinion seems to be that more room and better shipping facilities are needed, taxes less burdensome and discouraging to manufacturing enterprises, and a belt railroad with which all the manufactories should be put into communication.

The manufacturers of Cincinnati richly deserve the best treatment at the hands of its citizens, and we shall hope they will get all they ask for. The products of most of the manufacturers interviewed are familiar to our readers, and the countenances of many of them, *i.e.*, the real countenance, not the pictures printed by the *C. G.*, which are libelous, and we are quite sure that Mr. Charles Davis has good ground for action against the paper at any rate. Mr. Thomas P. Egan puts the value of wood-working machinery annually made in Cincinnati at $3,000,000, and declares that in wood-working machinery the city not only leads the world, but produces a greater value than any three or four other cities taken together. In the production of machine tools, too, the city is rapidly gaining.

On the Cultivation of Inventive Capacity by the Solution of Constructive Problems.

By Leicester Allen.

Solutions to the problem given out in the American Machinist in its issue of December 29 have been quite numerous, but not so various as were sent in for the hub movement problem. Perhaps this results from the fact that some particular solutions were more obvious than others, and these have been seized upon with the effect that other less obvious methods have not been sought. However, I am inclined to think this result has been caused by the rather narrow limits imposed by the restrictions of the problem itself.

Before proceeding to present the solutions that have been forwarded to me, I will say that, having only defined the ultimate purpose of the rotary movement of the spindle in my statement of the problem, some have misapprehended the effect produced by such a movement. As the sponge has a somewhat irregular form, the action sought was an expansion of the saturated swab through centrifugal force, in such manner that every part of the interior of the tubes to be oiled would be covered with a film of oil by a single passage of the sponge. The revolution of the spindle when withdrawn through the tube is merely incidental, though it perhaps secures a rather more uniform distribution of the lubricant. The centrifugal action, moreover, tends to throw the oil from the interior pores or interstices of the sponge toward the exterior, so that, once saturated, the sponge may be used for a considerable number of tubes before again charging it.

In Figs. 1 and 2 are respectively shown two different solutions sent in by Mr. Walter Gribben, of Brooklyn, N. Y., who has, as will be remembered, already contributed not a little to the interest of this series of articles. Mr. Gribben expresses some hesitation about sending in two solutions—a hesitation entirely superfluous, as if he had sent in a dozen they would all be welcome, if all were found worthy of notice. This remark applies not only to Mr. Gribben's solutions, but to those of any other reader who takes sufficient interest in such problems to attempt working them out. Mr. Gribben explains as follows:

"Fig. 1 is what occurred to me first, and would probably be more mechanical in its action than Fig. 2, but the latter possesses the merit of fewer parts, and might act well enough for the purpose for which it was made. Fig. 1 shows a transverse section through the sliding stock *A*, its spindle *F* and bed *B*. A stud carrying two loose pulleys *D* is driven tight into the bottom part of slide *A*, about midway between its ends. The pin *E* is driven tight in the spindle *F*, about midway between its bearings, and to it the middle of the cord *G* is fastened. The cord takes several turns around the spindle *F* on each side of *E*, passes under the pulleys *D*, and then to stationary supports, one on each end of the bed *B*, the one at the further end being shown at *C*.

"If the cord in Fig. 1 were left somewhat slack, then a given point of the sponge would traverse different paths on the forward and back strokes, which might be a desirable feature, as thoroughness of lubrication of the tubes was of prime importance.

"In Fig. 2 the cord *G* is fastened to the pin *E*, takes several turns around the spindle *F*, and then is fastened directly to the bed at each end, as shown. The location of the points at which to fasten the ends of the cord would be a matter of actual experiment, and they would probably have to be placed further apart, in an axial direction, than I have shown them, in order to give a quicker pitch spiral to the cord. In Fig. 2 the cord would not be equally slack at all points of the travel of the sliding stock; but as this is not an instrument of precision I think it would go."

In Figs. 3 and 4, Mr. Jas. T. Cowley, of Lowell, Mass., has reproduced the drawings

illustrative of the problem, and has added thereto the delineation of a device for effecting the desired movement. It will be seen that, while the construction is varied, it comprises the same mechanical principles as that of Mr. Gribben's first solution above given. I extract from Mr. Cowley's letter the following explanation:

"To the base of the carriage *F* is cast an upright *J*, upon which is journaled two grooved wheels *K K'*. A cord *L* is fastened at one end at *m*. The cord passes under the wheel *K*, then around the shaft or spindle as shown, and then under the wheel *K'*, the other end of the cord being then fastened at *m'*. The cord may be fastened to the shaft at *n*."

Mr. W. J. R. Alexander, of Meadville, Pa., has favored us with the solution illustrated in Fig. 5. His explanation of the device is substantially that following:

"A cord *a*, or small round belt, is secured at both ends, and passes over a winding drum, as shown at *b*. The wheel on one end of *b*, which comes in contact with a strip of leather or rubber cemented or otherwise fastened around the spindle, causes it to rotate as the sponge enters and passes through the tube."

Mr. Alexander adds that, "of course, by omitting the drum and wheel, and winding direct on the spindle, the movement would be much simpler, but by having the spindle only ½" at winding, the sponge would only rotate a little more than twice each way, which, I take it, would not be as much as wanted."

We have in this solution a means for multiplying the rotative motion of the spindle, which is a step in advance from the preceding solutions.

Figs. 6, 7 and 8 are respectively a side elevation, a plan view, and an end elevation of a method of effecting the desired movement, contributed by Mr. Albert L. Colburn, who will be remembered as contributing an excellent solution to the hub problem. The parts in the figures are lettered the same as in the problem. The parts by which the motions desired are obtained are a bracket-bearing *K*, shaft *L*, with drums or pulleys *m* and *n* carried by the shaft *K*, and the belts *o o'* and *p*. In the plan view, Fig. 1, the top and handle of the sliding stock are removed to show better the spindle, and the manner in which the belt *o* is applied to it. The bracket *K* is attached to the base of the sliding stock *F* by two screws, and, of course, it has the same reciprocating motion as the stock. The pulley *n*, at the lower part of the shaft *L*, is engaged by the belt *p* that is wrapped around the pulley, and has its ends attached to adjusting tightening screws *R R'*, as shown in Fig. 6, the belt being slotted at *R*, so that it can be drawn tight before the screw *R'* is tightened down upon it; thus this belt can always be kept as tight on the pulley *n* as necessary to secure positive action. The pulley *m* has thereto attached the belts *o o'*, these belts being also attached to the spindle *F'*, one of them winding off as the other winds on, after the manner of a clock spring.

I think this arrangement is faulty, because it seems that the length of either of the belts, measured from its point of attachment to the point where it is tangent to a surface concentric with the axis of the spindle, will always vary, on account of the belt winding off or upon itself. However, Mr. Colburn has given an alternative arrangement in the letter accompanying the drawings, which is to use one belt instead of two, passing this belt spirally around the spindle like the thread of a screw, and attaching the ends to the pulley *m*, as described for the belts *o o'* shown in his sketches. This arrangement would, he explains, give nearly one revolution of the spindle for every inch of advancement of the sponge, and, of course, reverse the rotation when the sliding stock is drawn back.

Mr. Colburn has shown the bracket as at the front of the sliding stock, but thinks it might be more conveniently located at the back side. He also makes some suggestions looking toward obviating any tendency of the spindle to spring, but as the power required to give the required rotation is very slight, the pull of the belt is not required to be great; as a matter of fact, the spindle does not spring sensibly. The number of parts added are *K*, *L*, *m*, *n*, *o*, *o'*, *p*, which exceeds the limit by one part, but if *o* and *o'* are replaced by the single belt named as an alternative, the limit will not be exceeded; the screws, or other means for attachment (we are conducting these problems on liberal principles, and not splitting hairs) are not counted as parts in the mechanical sense *of essential parts*, or such parts as contribute to the production of the motion sought, any more than glue or cement used for an attachment would be so counted.

From Mr. John T. Slocombe, of Providence, R. I., we have the excellent solution illustrated in Figs. 9 and 10.

With reference to the scheme of these problems, Mr. Slocombe writes that he thinks "the solving of such problems helps to improve a person's idea-gathering faculties." Many such words of approval from other correspondents reach me.

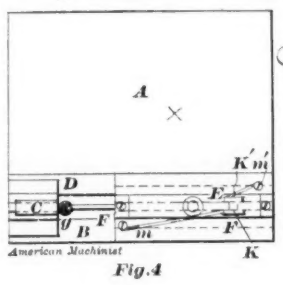


Fig. 4

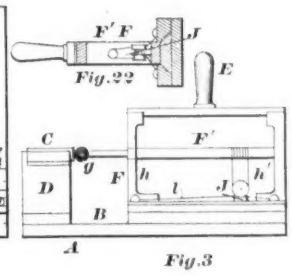


Fig. 3

Fig. 22

figures respectively being a side elevation, an end elevation, and a partial plan of the arrangement. The device, besides being a good mechanical construction, has the advantage that the parts are carried by the sliding stock, and concealed under it, thus relieving the upper surface of the table from any obstruction. In some cases this might add to the convenience of the operator.

The solution is reached through the addition of six parts, to wit, the grooved pulley *a*, keyed to the spindle *G*, the pulleys *B B'* attached to the sliding stock *E*, the pulleys *C C'* attached to the ways *F*, and the cord or belt *D*, both ends of which are attached to the stock. The reciprocation of the stock on the ways will thus give motion to the spindle alternately in opposite directions. As the rotary motion of the spindle requires very little power, I think Mr. Wright could dispense with the grooved pulley on the spindle, and thus somewhat simplify the mechanism while increasing the number of turns that the spindle makes at each reciprocation of the stock.

being slotted after the manner of a tool-rest in a hand lathe. From the bracket, and formed integrally with it, rises a stud that carries the pulley *H*. In the face of the pulley *H* is turned a rectangular groove, the center of which is in the same horizontal plane as the axis of the spindle, and which has a vertical breadth equal to the diameter of the spindle plus twice the thickness of the cord belt *h h'*. This belt is passed around the pulley, and makes three turns around the spindle. When the sliding carriage *F* is moved toward the stock *D*, the tendency is to slacken the part *h* of the belt, and tighten the part *h'*. The turning of the spindle prevents either tightening or slackening, except the amount that belt is stretched by the tension required to turn the spindle. This was my first solution; but, although simple, I found I could not get a sufficiently rapid rotation to spread the sponge as effectively as I desired by the centrifugal action. I therefore hit upon the method shown by Mr. Wright, and shown by him in Figs. 15, 16 and 17.

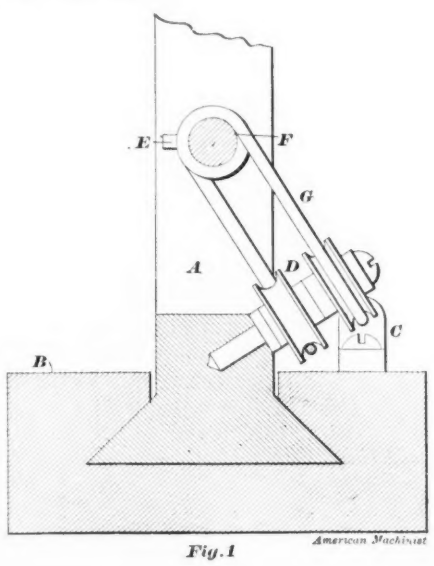


Fig. 1

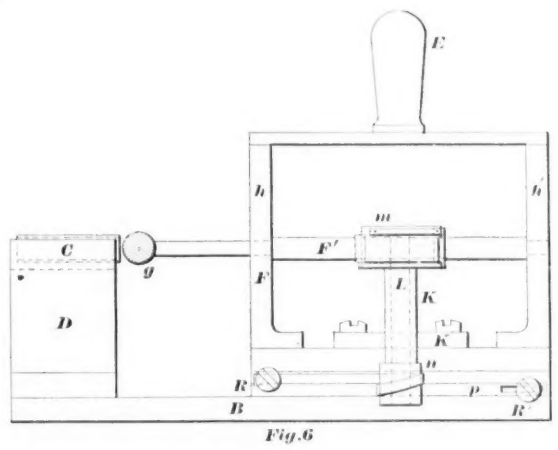


Fig. 6

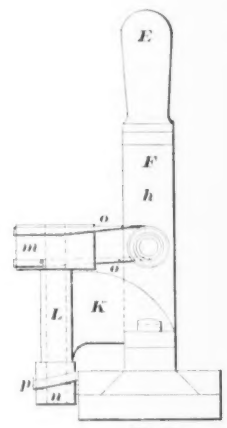


Fig. 8

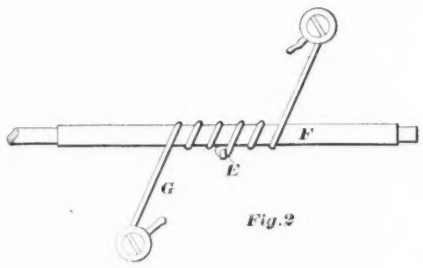


Fig. 2

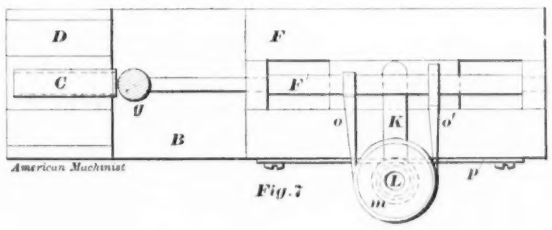


Fig. 7

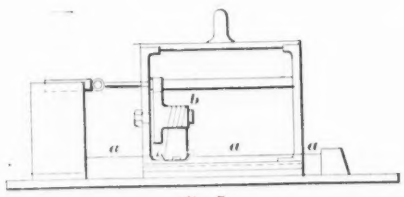


Fig. 5

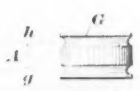


Fig. 10

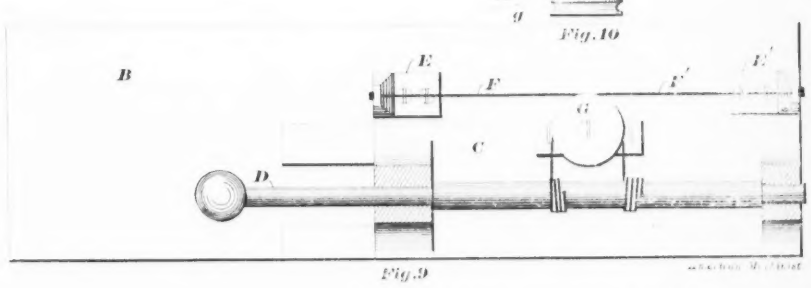


Fig. 9

In the figure, *B* represents the table. Brackets *E E'* are fastened to the table *B*, the one at *E'* being higher than the other by the distance *g h*, Fig. 10, this distance being that from center to center of the grooves in the doubled-grooved sheave *G*. This sheave is attached to a bearing on the base of the sliding stock, and moves to and fro with the stock. A cord *F*, fastened at one end to the spindle, is wound several times around the spindle, and making a quarter turn around the sheave in the lower groove of the latter is attached to the bracket *E*. The cord *F'* is similarly arranged, except that it passes through the upper groove of the sheave, and is wound in the opposite direction. It should also be noted that the distance *g h*, Fig. 10, being that between the centers of the grooves, is also equal to the diameter of the spindle plus one thickness of the cord. The number of turns that the spindle will make by the use of this device depends upon the ratio of the diameter of the spindle to the distance moved over by the sliding stock.

Mr. Edward H. Wright, of Hudson, N. Y., has sent in two solutions. The first of these is shown in Figs. 11, 12 and 13 (page 4), these

The second solution contributed by Mr. Wright not only differs in principle from any of the foregoing solutions, but is substantially the method I myself used after first trying the belt arrangement shown in Fig. 14. There are in this only three parts (not counting the stud-bolt fastening *I*) added to those shown in the original problem to effect the movement; but, by its use, I did not secure as many turns as I wanted, and so I finally used the method shown by Mr. Wright in his second solution, which I will presently present, arranging the parts somewhat differently, however, as I will explain further on.

In Fig. 14, which is a plan with the upper part of the sliding stock removed, I attached, by means of the tap-bolt *I* and a washer, the stud bracket *G*, the foot of the bracket

I think, however, that in this is concealed one of the prohibited elements, to wit, a bell-crank movement. While not, therefore, accepting it as a correct solution to the problem as given out, I present it because it is a good movement, and may possibly be found useful for some other purposes.

The segment of a bevel gear, and a slotted lever arm marked *a*, works on a vertical stud on the sliding carriage. A bevel pinion *B* is keyed to the spindle. The slot in the slotted lever arm is engaged by a fixed pin *e*, which is inserted in one of the ways.

The number of added parts is three. The pin in this case *must be counted*, because it is an essential working part of the apparatus. The concealed bell-crank movement is in the part *a*. I should not have alluded to my own device here, except that it so nearly resembles that of Mr. Wright. Instead of a segmental gear and pinion, I used friction wheels, which answered my purpose well, and I arranged the segmental friction wheel in such manner that the line *d d'* in Fig. 16 was nearly in line with the axis of the spindle at the beginning of the stroke, and instead of a fixed pin operating in a slotted lever arm, I pivoted a link to

the arm, the link working on a fixed pin at the opposite end. I thus obtained greater amplitude of motion in the segmental friction wheel, and hence greater velocity of rotation of the spindle. But I repeat that neither of these arrangements can be admitted as solutions of the problem, however well they may work in practice, because both of them involve a bell-crank movement.

A considerable number of solutions are reserved for future notice.

Give the Full Address.

If we may be allowed to make a suggestion to our English, French, German, Italian, Swiss and other foreign friends who occasionally write to us, we would venture the opinion that it would be a very great convenience to us and probably to others of their foreign correspondents, possibly equally ignorant of geographical matters, if every letter-head had upon it the full and complete address to which a reply should be sent —a reply we mean starting from a foreign country whose post-office officials know nothing of how to send a letter to a given town, unless the particular country in which the town is located is stated in the address.

Lesseps at the Bar of Justice.

One of the saddest spectacles in the world is that of a man who, having been connected with some great accomplishment, and having thereby been held in honorable distinction, has fallen from his high place in public estimation, and is brought to stand at the bar of justice as an accused criminal, with facts in evidence against him such, that, even if acquitted by a jury of his peers, a large portion of those who once delighted to honor, will henceforth hold his name in contempt. Such a spectacle the world now beholds in the case of M. Ferdinand de Lesseps. This old man, whose reputation and fame for an achievement that will never be forgotten, was such as even a king might envy, now stands convicted by a French court of justice, and before the even more terrible court of public opinion throughout all civilized lands, for frauds in the Panama Canal enterprise, such as for which even a far less noted man might bow his head with shame. And this is to be the sunset of a career once cited as an example of mental energy and financial ability the brightest that France could boast. It is now becoming evident to the entire world that these great business qualities lacked that basis of rigid moral principle without which the permanency of a good reputation can never be assured.

Premiums for Continuous Service.

At the American Watch Tool Co.'s works, Waltham, Mass., the following notice was posted June 1, '91: "At the conclusion of ten years' consecutive service in the employ of this company, employes will receive a present of ten days' pay, and the same amount at the conclusion of fifteen years." Since that time they have paid eighteen employes the ten years' bonus, and three employes the fifteen years' bonus. In 1893 there will be three employes to be paid the ten-year bonus, and three to be paid the fifteen-year bonus. Of course this bonus is a small percentage of the wages paid, but when this stated premium for continued service is given, it is pretty good presumptive evidence that there are other inducements for men to stay there, and the atmosphere of devotion to mechanical matters and of goodwill that pervades this shop is a most delightful one. We hope some one will inform us if a strike should occur in this shop. We will drop everything else and go to see such a phenomenon.

The *Dry Goods Economist*, in an elaborate article on the state of trade, comes to the conclusion that trade has been uncommonly good during the past year, and that any legislation likely to be brought about will not cause any interruption in the general prosperity.

Rubber Pattern Work.

By JOHN T. USHER.

VULCANIZING.

The vulcanizing of the india rubber is the most particular and difficult of any part or process connected with the entire art, and to a certain extent may be the most unsatisfactory, inasmuch as any slight error or oversight may result in a failure of the whole by blowing the article, or not having it hard enough, but if attention is paid to instructions given a failure will seldom occur.

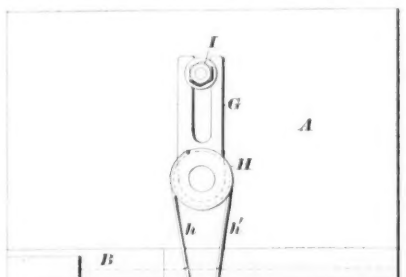
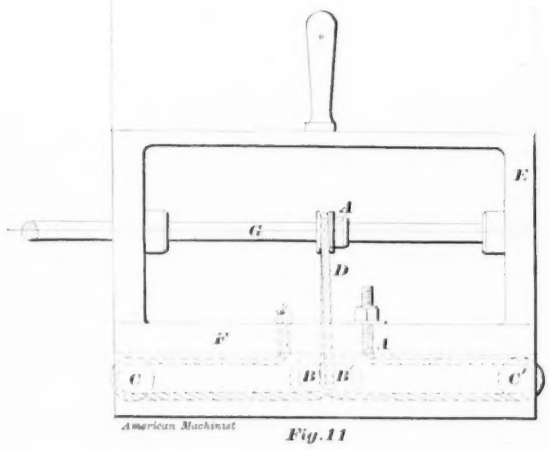


Fig. 14

Fig. 12



American Machinist
Fig. 11

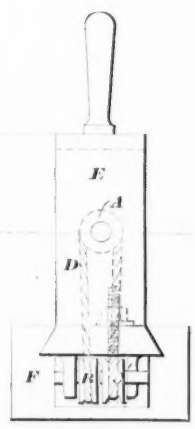


Fig. 13

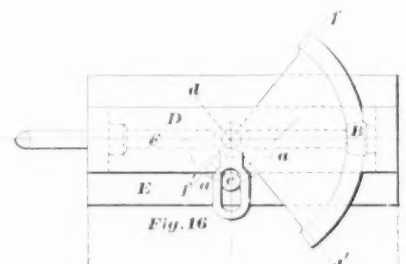
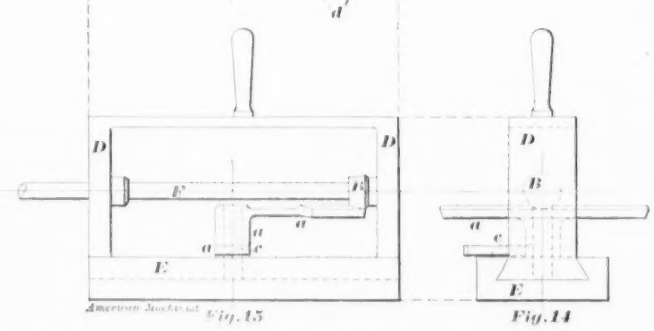


Fig. 16



American Machinist
Fig. 15
Fig. 14

India rubber is usually converted into vulcanite by one of the two following methods:

First, by the dry heat method, where the vulcanizer is in the form of an oven, or other apparatus, where the temperature can be raised from zero to the desired point, and held at that point as long as necessary; but owing to the difficulty experienced in operating vulcanizers of this description, they are seldom used, and therefore no further mention will be made of them here.

The second method is that of the steam vulcanizer, which is the one universally adopted, and which always consists of either a steam boiler in which the articles to be vulcanized are placed, and the steam generated to the point desired, and maintained at that point for a length of time sufficient to vulcanize or harden the rubber; or else of a steam vessel, in which the articles to be vulcanized are placed, and the steam supplied from an adjacent boiler. The latter form is the most convenient and easily operated, though each one is (other conditions being the same) equally reliable, as the temperature would, of course, be the same in each at the same pressure.

Any vessel or receptacle that will hold the molds after they have been packed, and which is capable of safely withstanding the necessary steam pressure, can be used as a vulcanizer; but it must not be inferred from this that any slip-shod arrangement or appliance can be used with safety for this purpose.

An efficient vulcanizer could, in the writer's opinion, be made out of a piece of 6″ or 8″ steam piping about 10″ or 12″ long, and threaded on each end, and a cap permanently fixed on one end, and a cover on the other end, like Fig. 36 (page 5), provision being made for connecting and disconnecting the same by means of a spanner or box wrench. If supplied with steam from an adjacent boiler, the body of the vulcanizer may be permanently fixed in position.

Fig. 36 shows vulcanizer cover with mercury bath, thermometer, scale and standard complete, same as used on nearly or all makes of the smaller-sized standard vulcanizers, with this exception, that in the covers the mercury bath always forms a part of the cover proper, the nipple being shown here for the purpose of illustrating how the mercury bath is, and may be applied to the cover or body of larger-sized vulcanizers.

As it is, the heat facilitates and produces a chemical combination or absorption of the sulphur (which has been previously mixed with the rubber by the manufacturer) with or by the rubber, whereby the latter is hardened or vulcanized. Thermometers are generally used to indicate the internal temperature of the vulcanizer instead of using a steam gauge to indicate the pressure, though the latter is in every particular more reliable, as will be hereinafter explained.

To insure as near as possible as correct an approximation of the internal temperature of the vulcanizer, the thermometer bulb is immersed in a mercury bath, which forms or makes a metallic connection between the bulb of the thermometer and the cover or body of the vulcanizer.

A, Fig. 36, shows nipple cupped out to form mercury bath, as explained above, and threaded at one end for a connection with cover or body of vulcanizer, and on the other end at *b'*, for a connection with thermometer standard *b c*. The joint *c'* is packed with rubber washers which fit closely upon the thermometer tube. The thermometer standard *b c* is bored out at *b''* just large enough for the thermometer tube to pass through, and *a C* for the tube to pass into, the thermometer scale being located behind the thermometer tube, and held between the tube and the standard in the semicircular groove of the latter.

The body of cover *D* is threaded at *D* for connection with body of vulcanizer, and grooved out at *E* for reception of rubber packing ring.

A safety valve is usually located at *F*, and on the opposite side, in the same relative position, a blow-off valve or pet-cock is usually fixed. A thin cover *H* which screws on the standard at *H'* is used to protect the thermometer when the vulcanizer is not in use, and to facilitate the handling of the same when it is hot.

The nipple *A* is reduced at *C* as much as possible to allow of the rapid transmission and communication of the internal heat of the vulcanizer to the mercury bath, and thence to the thermometer, where it is indicated on the scale of the latter.

This arrangement of a thermometer is practically the same on all makes of vulcanizers, and is intended to give as close an approximation of the internal temperature of the vulcanizers as it is possible to obtain; but it is a well-known fact that, under the most favorable circumstances, the best thermometers never indicate the correct internal temperature of the vulcanizer, and it is doubtful if it is known to what extent this variation of the actual and the indicated temperatures and pressures occurs in practice when a thermometer is used and relied on entirely for this purpose.

If all the air in the vulcanizer is forcibly expelled from the vulcanizer under pressure by opening the blow-off valve, a very tolerable approximation of the internal temperature may be gained; but even under the most favorable circumstances the writer has frequently observed a variation between the different indications of as much as 10 pounds presssure (from 90 to 100 pounds) when the thermometer indicated 320°, and in no instance has he known the gauge to register less than 90 pounds when the thermometer indicated 320°, this variation of from 15 to 25 pounds pressure being evidently due to loss by transmission of the heat to the mercury bath, and possibly to radiation, etc.

When the air has not been expelled from the vulcanizer under pressure, the gauge pressure in the vulcanizer may reach a point as high as 160 pounds before the mercury in the thermometer tube reaches the 320° mark, if the pressure and temperature has been raised from zero to the above-mentioned points very rapidly; that is, in from four to eight minutes. This excessive pressure does not exist for a longer space than from two to five minutes if the mercury is kept on the 320° mark, but the pressure must be gradually reduced until it reaches a point where it and the mercury will remain at their respective points without changing. This gauge pressure, as the writer has repeatedly demonstrated, could not be less at any time than 125 pounds (and is oftener 130 pounds, and from that to 140 pounds), as the rubber used could not be vulcanized at a less pressure (temperature) in the same given time.

To make this point plainer, I would say that in vulcanizing rubber which cannot be vulcanized as hard in less than 55 minutes, with a less pressure than 90 pounds (temperature 332°), the same rubber can (when vulcanized in a vulcanizer from which the air has not been previously forcibly expelled) be

vulcanized in half an hour, and that, as stated above, the same rubbers cannot be vulcanized in half an hour at a less gauge pressure than 125 pounds. Of this I am certain, as I have done it several thousand times during the past three years, and that when I had steam gauges fitted on the vulcanizers the above-stated results were verified in every instance.

In vulcanizing by thermometer when the air has not been expelled from the vulcanizer, the time for vulcanizing is 30 minutes on the 320° mark, 40 minutes on the 310° mark, and 50 minutes on the 300° mark.

When the air has been expelled from the vulcanizer, add 15 minutes to each of the above-stated times; and in some cases, and with some vulcanizers and thermometers, it may be necessary to add 30 minutes to the above.

If but one specific point were given of the temperature and gauge pressure at which rubber can be successfully vulcanized in a given length of time, many of those who are desirous of utilizing their knowledge of this art would find themselves enabled to do so at that particular pressure and temperature, especially if the steam is used from an adjacent boiler, in which a greater or lesser pressure may be carried. In consideration of this fact, the writer has instituted and conducted a series of experiments, extending over several months, to determine the shortest time in which the rubber can be vulcanized, at pressures ranging from 75 pounds to 140 pounds gauge pressure and the temperatures corresponding thereto.

In these experiments, Dohertys, MacCormick's, S. S. White's and Ash & Son's red and black rubbers were used.

As stated, the pressures and time given in the table below represent the least time in which the rubber can be vulcanized hard enough for practical use, as demonstrated by repeated trials; but with other rubbers, and even with different batches of the same rubber, a deviation of five or ten minutes either way may be necessary. A difference in the time can also be made if a longer time is taken to raise the pressure from zero to the point desired, and also on the time taken to cool the vulcanizer and contents after being vulcanized.

Table of the least time in which rubber can be vulcanized at different pressures and temperatures:

Gauge pressure, lbs.	Temperature, deg. Fahr., fractions omitted.	Time, minutes.
75	320	80
80	324	70
85	328	60
90	332	55
95	335	50
100	338	45
105	341	40
110	344	35
115	347	35
120	350	30
125	353	30
130	355	25
135	358	25
140	360	20

If the rubber is vulcanized five or ten minutes over the time given in the table above no harm will be done, but when it is vulcanized too long it becomes more brittle, and with some rubbers a noticeable shrinkage occurs. For these reasons it will be seen that a steam gauge is always preferable and more reliable than a thermometer.

The foregoing statements show the importance of having a vulcanizer capable of withstanding the excessive pressures to which it may be subjected, and also the necessity of expelling the air from the vulcanizer where it is desired to obtain a reasonable approximation of the pressures and temperature existing in the vulcanizer, when a thermometer is used instead of a steam gauge.

When a thermometer is used, trouble may sometimes be experienced through portions of the mercury becoming detached from the main body or column, and remaining in different positions in the tube. It is very important that these detached portions be reunited with the main body of mercury, as it is the whole column of the mercury which denotes the temperature. These detached portions may be reunited with the main body of mercury by taking the vulcanizer cover in the hand or hands, and repeatedly striking it evenly on a piece of waste or cloth (or its equivalent) laid on the bench or elsewhere, with just sufficient force to gradually jar the detached portion down the tube until it reunites with the main body of mercury; or where the cover is too large to be handled as above, the thermometer must be taken out of the standard, and the thermometer held perpendicularly in one hand, and then striking this hand on the palm of the other hand, or elsewhere, with sufficient force to gradually reunite the mercury as above. If the rubber is vulcanized for the length of time given in the table, it will vulcanize with the same degree of hardness at all pressures given therein. For patterns of ordinary thickness, that is $\frac{1}{8}''$, the rubber can be successfully vulcanized at any of the pressures given in the table; but for patterns which exceed $\frac{1}{8}''$ in thickness (unless precautions have been taken to prevent blowing), it is best not to exceed 100 pounds gauge pressure.

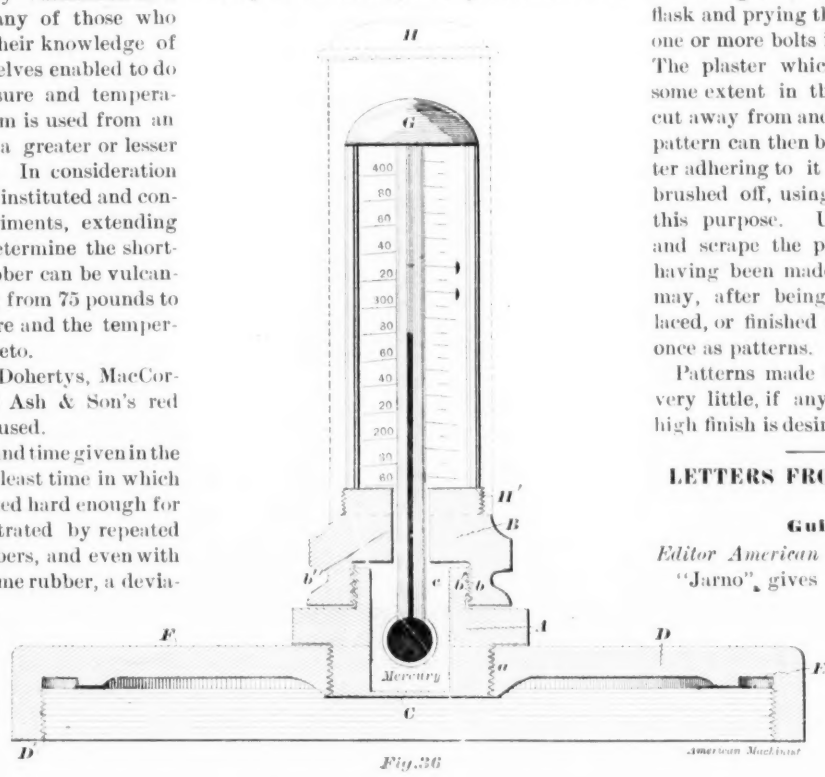


Fig. 26

Where a less pressure than 100 pounds is used for vulcanizing, the pressure should be raised from zero to the point desired in from ten to fifteen minutes, and when the pressure exceeds 100 pounds the time taken should be from fifteen to twenty minutes. The pressure is then to be held at the desired point for the length of time given in the table. The source of heat is then shut off, and the vulcanizer allowed to cool off for at least ten minutes for pressures below 100 pounds, and for fifteen minutes for pressures above 100 pounds. During this time the vulcanization of the rubber is really being completed. Therefore if the above-stated time is not allowed for cooling off, it must be added to the time given in the table. There is also a liability of the articles vulcanized being ruptured (if they are made in plaster molds) if the vulcanizer is cooled off too suddenly, and in the writer's opinion, where articles of ordinary thickness are blown, it is due to this cause more than any other, as the outer surface of the rubber when cooled off too quickly becomes hard (while the inner portion is still in a liquid state), thereby preventing the free escape of the gases, which to find an exit distend the body of rubber until it is ruptured. This may not be according to theory, but the fact remains just the same that where I have blown any article under $\frac{1}{4}''$ in thickness, it has been in nearly every instance where I have cooled the vulcanizer off and taken the articles out of the flasks sooner than usual, and that in making the same articles in quantities I have seldom seen or had one blown when a sufficient time was taken to cool them thoroughly.

In closing the vulcanizer after the patterns have been put into it, some water (two inches or more) is poured into it, but the water must not come higher than within two inches of the vulcanizer top; then just before putting the cover on, slightly smear the metal joint surface with "black lead" (stove polish); if this is done the vulcanizer may be opened and closed several hundred times before it becomes necessary to renew the rubber packing ring, otherwise it will seldom last more than from six to twelve times.

When the above-stated time has been allowed for cooling the vulcanizer and its contents, the vulcanizer may, if a small one, be immersed in water until it is cooled to or below 212°, and, if a large one, the pressure may be reduced to zero by blowing off the steam. The vulcanizer may then be opened and the flasks or molds can be further cooled off in water, but on no account must the patterns be disturbed in the molds until they are perfectly cold. If the patterns are made in plaster molds, the "flasks" are opened by inserting the blade of a jack-knife, or something else, between the two halves of the flask and prying them apart, or by removing one or more bolts in the covers of the flask. The plaster which will have softened to some extent in the vulcanizer can then be cut away from and around the pattern. The pattern can then be taken out, and the plaster adhering to it can be easily scraped and brushed off, using a small scrub-brush for this purpose. Unless it is desired to file and scrape the patterns to size (allowance having been made for this purpose), they may, after being sand-papered and shellaced, or finished up in the lathe, be used at once as patterns.

Patterns made in metal molds will need very little, if any, finishing, unless a very high finish is desired.

LETTERS FROM PRACTICAL MEN.

Guide Boards.

Editor American Machinist:

"Jarno" gives some excellent advice in the issue of January 26th, and what he told us in regard to guide boards is especially interesting.

Many of the rules pasted up in the machine shop and elsewhere are superfluous, and as some one has said, "they are like piecrust—made to be broken."

I should have very little confidence in a mechanic who, in order to perform his work, finds it necessary to consult a table of "speeds and depth of cut," so that he may know just how far he dare go.

There are certain things expected of a mechanic, and a knowledge of how to apply his brains under certain conditions is one of them.

A certain manufacturer of machine tools, not a hundred miles from New York, has found it necessary in the construction of his specialties to indicate by raised letters just where the chalk, waste, etc., is to be placed by the operator.

Just why this is done I have been unable to comprehend, unless it is on the supposition that the man who is expected to run the machine is devoid of brains, or perhaps, as Edison is said to have remarked, "In order to make an article sell construct it so simply that a mule can operate it."

Now the machines may be all right; I presume there are, because many of them are being sold to the best mechanics in the country; but really isn't this carrying simplicity or convenience to the ridiculous?

There are guide boards, however, which would be beneficial to some of us.

How often have I spent precious moments studying out an intricate drawing figured in decimals until I conceived the idea of tacking up a card (issued by some enterprising firm) giving the equivalent in a common fraction.

Now I simply refer to the card, and while it does not give the equivalent for every decimal it is near enough to obtain the correct size with little additional figuring.

It may be well enough for a draftsman or a man who is continually making use of decimals, and knows at a glance just what a certain decimal represents in a common fraction, to work from some of the drawings that are sent into the shop, but I think that the ordinary mechanic will find this card a great saver of time.

Have you ever seen a laborer trying to raise a piece of work weighing three or four tons with a chain $\frac{5}{8}''$ in diameter?

I have actually shuddered to see the risks taken by men through ignorance, working away in blissful unconsciousness of their peril, until I have referred them to a table giving the diameter of link and weight which the chain would safely carry.

This, I think, is another useful guide board, and one which would be the means of doing away with many of the too-numerous machine shop accidents.

Tack it up on the post where the chains are kept, or paste it onto the crane where it may be seen by those who need it most, or who may have occasion to use the chains.

Give us guide boards that will lead us to do the work in a more intelligent manner; but please do not take us for a lot of ignoramuses, incapable of judging anything for ourselves.

CHARLES STELZLE.

Brooklyn, N. Y.

Conical vs. Cylindric Cam Rollers.

Editor American Machinist:

Where is the conic cam roller theoretically right, and where is it practically best?

Various opinions have been expressed in your columns, some of which I believe are correct and others immature.

Mr. Pentz's thousands of bad conical rollers and millions of good cylindrical rollers are powerful facts and of great value in this roller question.

The conic stud for the conic roller is an eye-opener, and where tapered to the angle of the roller is, to my mind, exactly the thing for a conic roller, to secure greatest freedom of rotation. Such a conic roller will not press against its shoulder bearing with friction on a larger radius, but will act like the cylindric roller on its pin, because the surface of the pin is parallel to the external surface of the roller. Such a roller, I think, will not wear flat like the conic roller on a cylindric pin. The shoulder friction, I think, is the drawback for the conic roller on a cylindric stud, for two reasons: 1st, because this friction is at a larger radius than the pin friction, and often nearly to as large a radius as the outside of the roller, which, with usual lubrication, will slip almost as readily as the shoulder, and wear flat; and 2d, because friction at a lubricated surface under constant pressure throughout is likely to press the lubricant out, and bring the metals to actual rubbing contact with greatly increased frictional resistance as compared with the pin friction, where the roller in turning has only momentary contact with the stud once in a revolution, thus giving opportunity for entangling and dragging the lubricant between the surfaces for good and thorough lubrication. Thus a crank-pin is claimed to be more sure of thorough lubrication than a step bearing.

The conic roller has been said to be "theoretically right when it operates a slide which travels in straight guides parallel to the center of the shaft upon which the cam is mounted." This is true for a conic roller working against a conic *collar* with common vertex, but not for a cam, as above, as is evident by supposing the cam groove in the extreme case to be carried around to be parallel to the shaft of cam, at which limit the roller should be cylindric to work right. From this it would seem that the roller for the above case should vary from the cone to the cylinder as the cam groove changes its direction from where it is directly around the cam parallel to a hoop, to where it is straight along the cylinder.

But the conic roller is doubtless right when it is mounted on a *rock shaft* whose axis prolonged would intersect the axis of the cam, which cam is itself spherical, with a cam groove, the center of the sphere coinciding with the prolonged axis of the rock shaft. Is the conic roller theoretically right for any other case?

Some results of calculation have been col-

lected in the accompanying table, based on the supposition that the coefficient of friction is the same for the contact of the roller with its groove, with its stud, and with its shoulder bearing when pressed.

The last column shows that the cylindrical roller is decidedly less likely to slip and wear flat because its resistance to turning on bearing surfaces is only from 67 to 86 per cent. as great as for the conic roller, while the total frictional resistance of the cylindric roller is only from 1 to 12 per cent. greater than the theoretically adapted conic roller, as shown in next to last column, which gives the result of comparison of the entire friction of the cylindric roller, including that at its outer surface; on the supposition that the cylindric roller is put in place of the theoretically adapted conic roller. The last example in the table is about impracticable by reason of excessive taper of roller, and may be dropped out.

Hence as the total wear of the cylindric roller is from only about 1 to 6 per cent. greater than for the conic roller with best adaptation, and as the cylindric roller is more likely to turn and avoid wearing flat spots in the ratio of 100 to 77, it appears advisable to always adopt the cylindric roller in practice, especially in view of the fact that the exact adaptation of the conic roller sought by its use is very exceptional.

TOTAL WEAR AND FREEDOM OF TURNING OF CYLINDRIC AND CONIC CAM ROLLERS.

Radius of conic roller, large end, inches.	Radius of conic roller, small end, inches.	Radius of cylindric roller, inches.	Radius of axial pin for either roller, inches.	Radius of shoulder on conic roller, inches.	Length of roller, inches.	Total wear of cylindric roller divided by total wear of conic roller.	Frictional resistance of cylindric roller on pin divided by resistance of conic roller on pin and shoulder.
3/4	1	5/8	3/4	5/8	1	1.031	0.774
5/8	1/2	5/8	1/4	1/2	1	1.060	0.849
3/8	1/2	1/8	3/8	5/8	1	1.008	0.864
1	1/2	1/2	5/8	5/8	1	1.118	0.671

S. W. ROBINSON.
Ohio State University.

Micrometer for Cross-feed of Lathe.

Editor American Machinist:

In a general sense, there isn't anything new about using a micrometer for this purpose, but as the subject has not been before your readers very often, I thought perhaps this might not be considered an intrusion. "Mechanic" showed a device for the same purpose in the issue of Aug. 21, 1890, but as mine differs somewhat from his construction, I will describe it.

The main casting *A*, Fig. 1, has its central hole and keyway made a duplicate of the ball handle it is to replace (in case you are applying it to an old lathe), the ring *B* being made a sliding fit on the hub *C*. The ring *D* is a running fit on the casting *A*, and is made friction tight by the pressure of steel plate *E*, which is fastened by four countersunk screws to ring *B*. The ring *B* has two pins *a a* driven in tight on opposite sides (Fig. 2), which are pressed upon by the arms of the fork *F*, the pressure being regulated by the screw *b*. Thus the friction on ring *D* is made more or less, as desired, by turning screw *b*, which is easily done from the front side. The fork *F* is placed opposite the handle to partly balance the same, a complete balance being obtained by boring some large holes in the thick rim of *A* from the back side, so they will not show after the ring *D* is in place. This is the third micrometer I have made with a friction ring like *D*, but the other ones had the plate *E* screwed directly to the casting *A* by means of four small screws, let in from the back, like the one I copied from. The old arrangement involved less work in making, but was more awkward to adjust. However, as the amount of friction seldom needs altering, I am not sure but the old way was the better. I put in a small pin *c* to prevent the plate *E* from twisting on *A*, and thereby causing pins *a a* to get from under the arms of *F*. The ring *D* has a pin *G* driven in tight, and a single line or mark on its edge, by which to read, Fig. 3. The other part of the rig, shown in Figs. 4 and 5, is made to clamp on the hub of feed screw bearing, which hub can be turned parallel if it is not already so. The casting *H* is slotted on the side away from the operator, the slot containing the steel lever *K*, which is held in either its forward or back position by the spring plunger *d*. It would be better to have the casting *H* a little thicker, as it is nearly cut in two by the slot and spring hole, but I didn't think of this till after it was made—another illustration of our hindsight being better than our foresight. When lever *K* is in its back position, as shown in Fig. 4, the ring *D* travels around with *A*, and the pin *G* remains at whatever division it happens to be. But when lever *K* is pulled forward, its end comes in the path of pin *G*, and prevents *D* from rotating, any rotation of *A* causing the micrometer divisions to pass the reading point, which is always on top when the micrometer is in use. The pin *G* can come in contact with lever *K* from either side, so the device can be used on either inside or outside turning or threading.

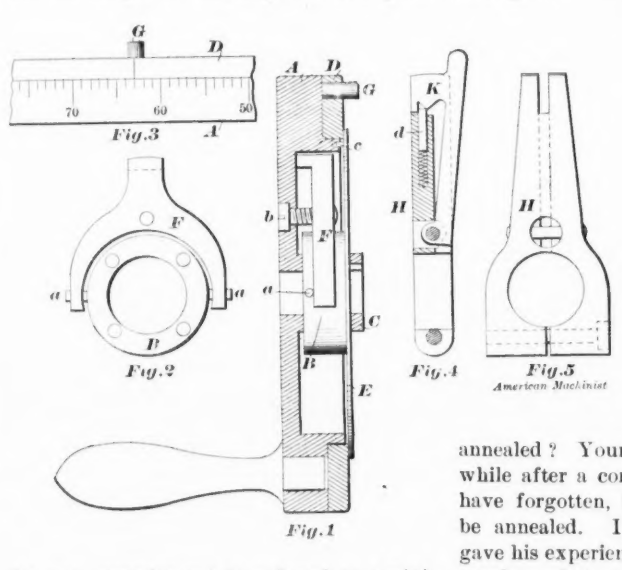


Fig. 3 Fig. 2 Fig. 1

As a threading stop, it lays away over anything I have ever seen, the depth of the successive cuts being measured to a nicety, and the danger of breaking the tool point from an excessive cut is reduced to a minimum. In running the carriage back after each cut, it is not necessary to remember the reading of the micrometer, as that is undisturbed if the feed screw is turned back less than one turn, which is generally sufficient on ordinary pitches; the only thing necessary to do is to feed the tool in the one, two or three thousandths, or whatever the operator desires, beyond its former position. For inside threading it is particularly valuable, as the lever *K* can be thrown out of engagement, and the tool run towards the front of the lathe whenever necessary to try in the male thread, and yet can be fed back to its former position exactly. In turning cylindrical work, when nearly to size, if measured with a micrometer or vernier caliper, and found, say .006″ too large, the tool is then fed in .003″, the operator can proceed to take the final cut with some degree of assurance that the work will be about the size he wants it The same conditions as to backlash in nut and bearings of screw, sharpness of tool and spring of same, should prevail both in the final cut and the one before it. This seems like a great deal of trouble when on paper, but it isn't so much of a job in actual practice as it appears to be. Besides, the production of good work, and lessening the liability of getting your shafts too small or your holes too big, is worth a little extra exertion.

Of course the micrometer will not measure the exact depth of cut, unless the tool is fed in radially, or is "on the center." The greatest distance above the center at which you can persuade a tool with 20° clearance to cut, will produce an error of about .001″ in .015″, and proportionately less as the tool is lowered. But then the error will always be on the safe side, and cause you to take *less* of a cut than the micrometer indicates.

This device also comes in fine where we have a piece of work driven on an arbor, and wish to face the side of it. After the work is in the lathe, and the tool clamped in place, if the lever *K* is thrown in engagement with pin *G*, and the tool fed up to the arbor till just a thin streak of light shows between them, it will leave the friction ring *D* properly set for that job. The lever *K* can now be thrown back, and the cut started from outer edge of work. When the tool gets within less than one turn of feed screw from arbor, the lever *K* can be thrown in gear again, and when pin *G* strikes it, then is a good time to stop feeding. In this way a cut can be run down close to the arbor without much danger of gouging into the same. It also comes in handy for setting tail-stock in line, or for setting it a given amount out of line. In fact, there are quite a number of uses to which the device can be put, that would suggest themselves to the thoughtful machinist, and I agree with "Mechanic" that this or some similar device ought to be on every good engine lathe, although there are many who would consider it an unnecessary refinement. I hope none of this latter class will waste their time reading this.

The apparatus shown here was made for a 14″ Reed lathe, having 7 threads per inch on cross-feed screw, so I put 143 divisions on edge of *A*. This gives 1,001 parts to the inch, instead of 1,000, which is not only a close approximation, but leaves the error on the safe side.

Fig. 4

Fig. 5
American Machinist

WALTER GRIBBEN.

Annealed Mushet Steel.

Editor American Machinist:

Some time ago a correspondent of the AMERICAN MACHINIST asked through the columns of Questions and Answers if mushet steel could be annealed? Your answer was no. A short while after a correspondent, whose name I have forgotten, informed you that it could be annealed. I am in doubt whether he gave his experience in using it, or, in other words, what trials and tribulations he passed through in machining it. I am led to believe that he simply saw an advertisement to the effect that it was being placed upon the market. This advertisement reached my eye. I showed it to the foreman of the shop where I work. He was surprised to think it could be annealed. I was surprised myself, also. However, some of this material was purchased, to be made into shank mills. Was it a success? The readers of this article can judge for themselves after reading this. This grade of steel was purchased direct from the agents. To work this steel into milling cutters was next to an impossibility; it was sent back to the agents to be annealed the second time, and was returned by them in no better condition. By hard work one shank mill was made, and only one. The result of this was that the cutter used in milling the teeth was spoiled, the time required to cut the teeth was just about ten times as long as it required to make them from other steel. As this so-called annealed mushet steel costs 75 cents a pound, while the best grade of English tool steel costs but 20 cents a pound, it will be seen that, with the extra time required to try to machine it, together with the loss of cutters, it is dear steel to use in this way. It should be borne in mind, also, that it cannot be used over again after it has become worn below size. It was found impossible to use oil when cutting the teeth. This steel was hardened in the usual manner required for this brand of steel. The end mill made from the mushet steel, when put to the test of cutting cast-iron at the same speed as the mills generally used, got sadly left. It was a failure. Mushet steel unannealed has its place. Will this experience, costly as it has been, prove useful to any of the readers of the AMERICAN MACHINIST? C. E. SIMONDS.

A Philosophical View of Copying.

Editor American Machinist:

Acknowledging your kindly notice of our pamphlet on milling, and in reference to our remarks therein on "Copyists," we should like to more particularly define the class of copyists we object to.

In designing the majority of machine tools, all designers are more or less copyists; we ourselves are copyists, or, in order to soothe the legitimate pride of the advanced machinist, let us coin a word, and distinguish the copyist, pure and simple, from the "adoptist"; we may enroll ourselves among the latter without misgiving. So long as a machinist does not encroach upon another's rights, he may honorably adopt any method upon which he can conceive no improvement; we here open a loophole for the "copyist," to which we will revert. There are few machines, however, so perfect as to admit of no improvement, and it is the right, we may say the duty, of every machinist to search out the weak points, and, if he has the ability, to remove them, at the same time adhering to those which are good. It is only in this way that advance can be made, following the natural law of evolution, and it is in this direction we personally endeavor to work. There is, however, the machinist who "*can conceive of no improvement*," because he has not the ability to do so—this is the copyist who copies every detail, good or bad, and will go to a great deal of trouble in that direction, even to the extent of purchasing a machine he wishes to copy. Indeed, this copying is to him probably quite as difficult a matter as original designing is to a better man; he has an object, however, in copying. He will generally take a machine upon which the original makers have concentrated their brains, and spent their money in advertising and bringing before their clients, until it has attained a recognized standing, and he will endeavor by underselling of inferior work and other means, to filch a connection which rightfully belongs to another.

This is the copyist we long to mop up the shop floor with, and is of the class to which we allude.

Clients of such a copyist should, however, bear in mind that he is not very likely to further improve his machines, whilst it is always the object and endeavor of the original maker to keep on improving, and he generally manages to do it, so that in any case the copyist is left behind, sometimes very much so.

The AMERICAN MACHINIST, being peculiarly American, is uncopyable in this country, otherwise we could welcome *one* copyist, however pure and simple he might be, and that would be the English editor who could give us a *British* AMERICAN MACHINIST. There is, however, sir, no fear of such a one arising, for if he had the brains to do it at all, he could not become a genuine, faithful "copyist," so that we must still look to our American post for one of our greatest literary pleasures—that is, the AMERICAN MACHINIST. LISTER & Co.

Keighley, Eng.

Forgings From Sibley College.

Editor American Machinist:

On several occasions of late years I have sent for your inspection samples of work performed by young men in the course of their regular instruction in the workshops of Sibley College and of Cornell University, as illustrating the proposition that systematic instruction, carefully graded and given by interested and expert instructors, is not only satisfactory in result, but is wonderfully efficient as compared with any hap hazard methods such as were formerly customary. I am reminded of this fact by the receipt from the instructor of our present sophomore class in this branch, of a batch of lathe, planer and other tools made in regular course, by a student who never had a blacksmith's hammer in his hands before in his life, and after only the equivalent of twenty days' work, full time. I should be glad to have your best judges of this class of work inspect them, and say whether they have been accustomed to see equally good or

better work come from the forge of any trained and experienced tool-dresser in the best shops with which they may be familiar.

The material is crescent steel; and the work was done by the student without assistance or suggestion, at the end of a systematic course of instruction of 200 hours or less, the course beginning, as is customary, with simple tasks, the making up of the fire, the management of the heat, the heating and forming of easy shapes in iron, welding and making up various standard shapes, as chains, forge-tools, and, later, more difficult work: this being followed up by forming tools in the softer metals, and then in steel, heating, cooling, tempering and finishing them, until the learner is competent to undertake, unaided, such a job as these tools illustrate. It should also be said that the collection here sent does not represent a selected lot—successes attained after successions of failures—but a job made up offhand, as any good tool maker would make them, and tempered in a business-like way that would delight any old tool-dresser.

The maker's name is on each tool, and is that of a good student as well as a good workman; for it is our experience that the boy who is well fitted for engineering is neither a mere book-worm nor one carrying his senses in his finger-tips alone. A high order of mind is just as essential to the good mechanic as to the exact theorist; and the designing and constructing engineer must combine both elements of success. This work is not performed under the stimulus coming of anticipation of life-long work at the trade; but the purpose is simply to become competent to direct and to appreciate good work, and to insure the best results in the construction of the designs that the young engineer hopes, some day, to be competent to make, and the work that he hopes some time, also, after suitable practical experience, to direct. Power of appreciating all good work, and the ability of all good workmen, is as essential to business success in every branch of engineering and manufactures as that of designing the most refined and intricate of machinery.

Many similar illustrations of this successful employment of systematic methods of instruction, as in the other tool-using vocations, in drawing and designing, and in the use of the modern methods of exact measurement in the laboratories, in engine and boiler trials, and in many other branches of contemporary technical education, might be offered; but this is selected largely, perhaps mainly, as illustrating also the fact that the real mechanic is distinguished by his ability to use his hands, even though but a school or college lad, and is, without hesitation, ready to employ his talent in an art which, while offering opportunity to display that talent to great advantage, might be expected to repel the aspirant to distinction, in what is coming to be admitted into the list of the learned professions, by its essential discomforts of heat, dust, and soiled fingers. But we find that the young man who, on proper occasion, wears a dress suit and kid gloves, and takes his young lady acquaintances to "sophomore cotillions," and to junior and senior balls, may also find a no-less real, if very different pleasure, in learning from the blacksmith, the machinist, or the pattern maker those arts which he expects, at some future time, to make contribute to his professional success quite as effectively as his own genius and learning.

R. H. THURSTON.

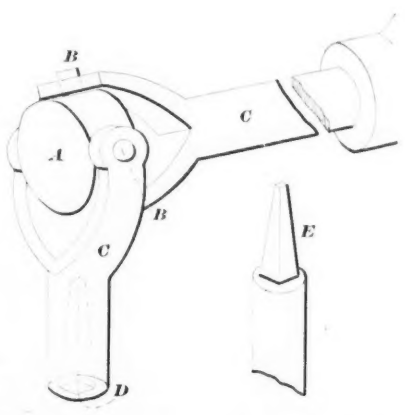
Sibley College, Cornell University.

A Universal Screw driver.

Editor American Machinist:

We all know how exasperating it is to be compelled to remove, perhaps, carefully adjusted parts of a machine to tighten a screw left loose, or to place a screw in an unsatisfactory position, or where simply because it comes too close or under an overhanging part, and a screw-driver large enough to be of sufficient strength cannot be used to necessitate an aggravating outlay of useless labor. Until the other day, when I had the opportunity of forming the acquaintance of Mr. F. L. Haviland, the author of many an instructive article and tool contributed to his own and allied branches of the mechanic art (though I here say, with due credit, under a *nom de plume*), I was without this highly-prized instrument, which, with his kind permission, can, perhaps, be best described by the drawings and explanation he gave me, after which I was able to make the tool in barely 45 minutes.

The two double eyes *C C* may be formed, one carrying the handle, the other the screw-driver bit, which, in order to use any length desired, was drilled and filed to receive the bits, as *E*, from $\frac{5}{16}$" round tool steel, sawed to split equally, heated and shaped. The eyes



were then drilled for the pins *B*, which, in this case, were $\frac{5}{32}$" round head iron screws, made to bottom in holes, tapped in the yoke or cross-piece *A*, which is turned to $\frac{5}{8}$" diameter and cut off $\frac{1}{4}$" thick from a bar of soft tool steel. Though I used instead a bearing ball, Mr. Haviland's way is certainly quite as good—quickest and cheapest. For reaming and tapping this tool is equally efficient, and I fail to see why it should not be put on the market. FRANCIS M. CATALON.

Inventors and Patents.

Editor American Machinist:

It seems that my meaning of impostor inventor was not understood as I intended it should be. I did not mean a man who steals other people's inventions and makes money out of them through his own shrewdness, for such a one need not be an inventor at all, but instead a good business man.

A man who steals a horse is called a horse thief, also one who steals a machine might be called a machine thief; he might call himself a machinist, and claim that he made the machine; this, I think, would not cause him to become an impostor machinist, but instead just a plain impostor. I should think that an impostor machinist would mean one who at least attempted to work at the business. I did not mean by imposter inventor one who fails to make money out of his inventions on account of lacking good business ability. I did mean by it that class of self-styled geniuses who always imagine they have something that is going to astonish the world, when the real fact is, the thing is impractical, and is found so as soon as it is tried to put it to practical use. If one of this kind is a fraud, to go with the rest, he will sometimes cheat men out of money; but in the light of true business methods, giving value for value, he is an impostor. I said I never knew one of this kind to make money, meaning by honest methods.

A gentleman who is quite well posted on sub-marine wrecking, was telling me of an impostor inventor's scheme for raising sunken vessels.

His scheme would work all right if vessels were always sunk prepared for raising with his device. He could not make money out of his invention because there was no money in it. He found himself stuck with his invention on his hands; then he made another invention which, it seems, he was better adapted for making, and one that perhaps he might have made some money out of if he had carried it out. The last invention was a scheme for using the first.

It was to obtain a worthless vessel and prepare it for sinking, with a special idea of raising her with his first invention. Then to advertise that his first invention was for sale, the description describing its good points, forgetting the bad ones; also to advertise that at an appointed time there would be a public exhibition of its workings. The public exhibition would be when he raised his prepared vessel; after which he planned he could sell his worthless scheme for a large sum. On his first invention he was an imposter, because he attempted to do things that he was unfitted for doing and so made a botch of it, but on the second invention he seemed to be more at home.

"A Lawyer," in your issue of December 8th, introduces a natural uncultivated specimen of inventive material, and seems to ridicule my idea that an inventor to be successful should know what was born in him. I will excuse "A Lawyer" for this little blunder, for further along in his letter he corrects himself by saying, "these fiddling inventors are of little use but make progress." This is exactly my idea; some of them make progress by learning.

A raw recruit might devise a scheme for dredging a river that will not work except on paper and in the Patent Office, and perhaps after he has learned something of the business he can design one that will actually remove dirt. There are plenty of ways for inventors to get information about the needs of people and the difficulties to be overcome by a device, without applying for a patent and then finding out. "A Lawyer" seems to lay great stress upon the patent scheme for educating the young (I am glad he has found such good use for it), and calls up an incident from the life of President Lincoln, but for what purpose I fail to see. He says Mr. Lincoln took out a patent and afterwards became President. I know a young man who took out several patents and is now dead. I fail to supply the missing links between these two incidents of a life, and so does "A Lawyer." There are a great many vague ideas existing about rapidly getting rich through patented inventions that come to mind like a streak of lightning, and are just as uncertain about whose mind they are going to strike, whether a man who has not looked for them, or one that is always working in that direction. There are dishonest persons who try to encourage these vague ideas by telling simple stories like this: "A gentleman noticed that the hole in his watchkey was stuffed up. A very happy thought instantly occurred to him about putting a hole through the key, as is now common. He applied for a patent and was rich." Can you think of an easier way? This may be true, and it is also true that gold has been discovered by accident, and people have accidentally fallen heir to great fortunes, but these cases are rare, and it is deceiving to tell of them in a way to make people think they are common.

The real facts are that to make money from inventions calls for good solid work, and as much of it as to make money in other directions.

"A Lawyer" tells how to make money out of inventions, and at last sums it all up and puts it into a "nutshell." This is the substance as I understand it:

"Your invention must be better than anything else for the purpose."

You must be able to manufacture it yourself cheaper than anybody else can possibly do it.

You must get it upon the market before anybody else.

You must be the smartest man in the world. "For an invention that will stand the above test I will get the patent free of charge."

I should think this would be a safe offer, because the smartest man in the world is quite a rare article, and even if found, there is a chance for a difference in opinion. I should like to know what this very smart man is going to use a patent for.

Is it out of pity for some poor foolish competitor, who out of his foolishness might think he could do business, and who might be prevented from trying from fear of the patent? I agree there is a chance to make money by a properly managed manufacturing business, even if you can't beat the world; there is a chance to make something, if you can do as well as others.

Manufacturing, though, is independent of invention.

If I create something, it seems only reasonable that I should receive a little more benefit from my own creation than the public, but according to that "nutshell," the creator of things should be at a great disadvantage with the public.

According to that famous "nutshell" Mr. Corliss should have perfected his engine at his own expense, and then openly have described his work in such a way that anybody could use his invention, and then compete openly with anybody who saw fit to go into the business, depending for his profit on his ability to beat the whole world out of sight, at not only inventing but manufacturing as well. Is this not asking considerable of a man? Is it not much like asking some other fellow to support you?

According to the existing state of things, an invention that is of no value is easily obtained and just as easily protected; there will be no infringements, and its life is a peaceful sleep. Also an invention that has value will often sleep peacefully till some one, with extra enterprise by hard work and considerable money cost, proves its value, then the infringements will commence.

If the inventor is poor or has expended his wealth introducing his invention (an advantage that the infringer gets free) then he is unable to protect his claims, and so anybody can use his invention; but if, before the term of his patent expires, he manages to raise the necessary wealth to fight the infringers, then they all cry *injustice*. When the infringers entered the business they might have known they had no right to do so; but as infringing a patent is not considered a crime, and as in most cases infringers are not molested, they have entered the business for the profit there is in it, and after a while have grown to believe the invention their own property, so when they are forced out of the business it seems hard.

This is the case of the electric lamp just at present, I believe. A great many people are crying injustice, but if it is an injustice then the whole patent system is wrong.

Now as a suggested improvement, I should like to consider again the plan of having the cost of patents raised so as to allow the government paying the costs of suits against infringers.

Mr. Redfield, in your issue of January 26th, says this would be impractical, and does not seem to think enough of it to give his reasons for so thinking, but he favors us with an incident: "John Smith patents a device Tom Brown has been using for some time. As Smith would have a guaranteed patent, Brown would be helpless." I fail to see why in this case Brown would be any more helpless than he would be by the present arrangement.

By the present arrangement he would be sued by the party holding the patent, if that party was able to make use of his privilege, and by the other arrangement he would be sued by a third disinterested party, who would not be so likely to use unfair evidence as Smith would.

I cannot see why this plan would be impractical, or how it would raise the cost of a patent beyond the reach of people who wanted them. If this plan was tried for correcting past wrongs, then there would be an awful commotion, because this bad state of affairs has been going on so long that most good things are infringed; but if it should start with the present, after a few practical examples, these chronic infringers would have more respect for a patent, and many suits would not be called for, and we would not hear so much of this peculiar "injustice."

If the government paid the costs wouldn't suits make better time in the courts?

A MECHANIC.

Mr. Fred A. Rich, who has been for years connected with the business of the late S. A. Smith, will, it is understood, continue the business, and has been appointed the Chicago representative of the Brown & Sharpe Mfg. Company.

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A Clear Case of Garbling.

Our attention has recently been called to what purports to be an extract taken from the AMERICAN MACHINIST, and which appears in the "Illustrated Circular of the Hartsfeld Furnace and Refining Co., Newport, Ky." The alleged extract in question, as published in Hartsfeld's circular, reads as follows:

USE OF ALUMINUM ALLOY IN IRON FOUNDRIES.

Mr. David Spence, in AMERICAN MACHINIST, says:

During the past winter I have used aluminum alloy composite in foundry practice, and find it is a splendid thing to make iron fluid and clean. It seems to take all the impurities out of the iron when it is charged in the cupola with the pig-iron. Ten pounds of aluminum alloy composite to 100 pounds of pig-iron will produce good, sound castings free from blow-holes.

It is as good in the use of crucible steel as in iron (its effects). It produces a sharp and solid casting, makes a uniform grain. It takes away the tendency to chill in cast-iron.

I recommend it to persons making tool castings, such as face-plates, and in fact all kinds of work that has to be planed, milled or turned.

There is another thing I like in its use, and that is, it does not weaken the iron or take the strength from it, but rather adds to it. We are having good success with it in sewing machine castings. I believe in progress in foundry practice, and am always willing to give such things a trial, if I find that they are a benefit.

I want other foundrymen to know it. I believe we are making rapid progress in American foundry practice, and the foundryman that is satisfied to run his foundry in the same old-fashioned way his grandfather did, is going to be left. And the younger and more progressive men will come to the front.

On looking up the back files of the paper, we discovered that our issue of March 5, 1891, contained the following article, which we republish below entire and verbatim, without other change than the italics, which are ours, and which are used to enable our readers to make a more ready comparison of the two versions:

THE USE OF "ALUMINUM" IN IRON FOUNDRIES.

Mr. David Spence writes us:

During the past winter I have used *aluminum* in foundry practice, and find *that* it is a splendid thing to make iron fluid and clean. It seems to take all the impurities out of the iron when it is charged in the cupola with the pig-iron. Ten pounds of *Cowles' ferro-aluminum to* 2,000 *pounds of pig-iron* will produce good, sound castings free from blow-holes.

It is as good in the use of crucible steel as in iron (its effects). It produces a sharp and solid casting, makes a uniform grain; it takes away the tendency to chill in cast-iron.

In steel it reduces the shrinkage, and increases the welding properties in both wrought-iron and steel.

I recommend it to persons making tool castings, such as face-plates, and in fact all kinds of work that has to be planed, milled or turned.

There is *one thing that* I like in its use, and that is, it does not weaken the iron or take the strength from it, but rather adds to it. We are having good success with it in sewing machine castings. I believe in progress in foundry practice, and am always willing to give such things a trial, if I find that they are a benefit.

I want other foundrymen to know it. I believe we are making rapid progress in American foundry practice, and the foundryman that is satisfied to run his foundry in the same old-fashioned way his grandfather did, he is going to *get* left. And the younger and more progressive men will come to the front

It will be observed that Mr. Spence's article, as published in this paper, mentioned distinctly "aluminum," and "Cowles' ferro-aluminum," with reference to their use in foundries, but in no degree or manner mentioned the so-called "aluminum alloy composite," which the Hartsfeld concern is putting on the market, and which from its very name purports to be, not aluminum, but an alloy of some sort supposed to contain merely a greater or less proportion of that metal.

It will also be noticed that there is another very important difference in the quantities of pig-iron referred to in the two versions of Mr. Spence's communication to this paper, the genuine version stating it as "2,000 pounds," while the Hartsfeld version has it only "100 pounds." One of the paragraphs comprised in the genuine version is omitted in the Hartsfeld circular.

With the merits or demerits of the Hartsfeld Company's "composite" as an article of manufacture, we have no present concern, but we do feel called upon to entertain a decided opinion as to the character of the business methods relied upon to bring about its sale, as exemplified in this instance. We do not see that anything beyond a comparison of the article published in our paper with the version appearing in the Hartsfeld circular is required to show that the substitutions contained in the latter were intentional, and it is plain that by this garbling our correspondent is apparently made to say things which he did not say, and had no intention of saying.

Our readers will, as we think, find little difficulty in drawing the proper inference as to the value of an article, the sale of which has to be pushed in that way. We make this exposure because we do not intend to allow our paper to be misrepresented or used as a decoy, without protest on our part.

School vs. Shop.

Elsewhere in this issue we publish a communication from Dr. Thurston, which we are glad to receive, and think it contains several very suggestive thoughts bearing on the difference between systematic instruction given for the purpose of teaching and such instruction as is often given in shops—not only not systematic but not given with any other object in view than to make money and avoid bother with the person taught.

The tools referred to by Prof. Thurston, when examined in the light of his statements as to the experience of the makers of them, are certainly very creditable, so far as can be judged without using them, but perhaps we cannot do better than quote the remarks of a practical machinist and tool-maker who, seeing them on our table, examined them, and expressed his opinion about as follows:

"The tools certainly look well, and, so far as can be judged, are a good set of tools, though to paraphrase a familiar saying, the proof of tools is in the using of them, and when these are tried in use they might not prove of much value. So far as their form is concerned, about the only criticism I could make would be in the diamond-point lathe tools, which have too much inclination forward, and would require to be set too high in the lathe—a quite common fault, however. Then I notice that the right-hand tool leans off to the left in the direction of its cut, while the left-hand one leans the other way, carrying the cutting edge in each case out at one side of the body of tool. This is probably done with the idea of giving them clearance at the side, and is not only unnecessary but injurious, the forward inclination giving them plenty of side clearance.

"Then as to the ability of the forger of these tools as compared with a toolsmith, I think no one can tell much about it without seeing him work. Some toolsmiths forge a diamond-point tool at a single heat, and almost entirely by the labor of the helper, while others must heat and re-heat and labor hard in shaping such a tool. The one is much more skillful than the other, and yet the tools made by the two men may look practically alike when finished.

"These tools have been ground, which is no part of the toolsmith's business, and largely prevents his work being judged, especially as a large proportion of the surfaces, always in shops left as they come from the smith, are on these tools ground smooth, thus obliterating the marks by whch the skill of the smith might to some extent be judged. On the cape chisel there are distinct marks of filing on the flat sides of the blade, and in the fillet where this joins the body of the chisel, filing evidently done either while the steel was hot or before the final heats were taken, something which no toolsmith would think of doing, and which would not be allowed in any shop I ever knew of.

"Again, nearly all these tools, though ground to shape, have the temper color on them, showing that they were drawn after grinding. Another thing which shop customs do not allow."

This criticism made by a man who was for years a professional user of such tools, and who is a friend of Cornell University and of technical education generally, must also be considered as instructive, and, when compared with Prof. Thurston's statement, will show the different ways men have of looking at such matters, and why the "practical men," as distinguished from the school men, so often misunderstand each other. The fact is, the tools are creditable when the facts connected with their making are considered, and may be such as fully answer the purpose for which they are made, but in a shop where they would have to compete with tools made by a professional toolsmith, in cost of making and in service, they would probably fail.

But it is to be remembered that the two kinds of tools are made for an entirely different purpose and are viewed from entirely different standpoints.

It is announced that very soon now the Inman steamers, "City of Paris" and "City of New York," will be flying the American flag, and that suitable ceremonies will mark the important event. By this we not only gain the fastest steamer, but two more steamers are under way at Cramp's for the same line, that will surpass these in size and probably in speed, while plans for three more are nearly completed, these being in excess of what the Act of Congress admitting the "City of Paris" and the "City of New York" to American registry requires.

Literary Notes.

We have received a copy of the Sixth Edition of Mr. Geo. B. Grant's "Treatise on Gears," the matter of which, it will be remembered, was published in our columns in 1890. We are pleased to note that this new edition has an index, which will add very much to its value as a book of reference. Mr. Grant states that "it is not necessary that the student, especially if he is a workman, should learn all that is taught in this book, for it contains much that is not only difficult, but also of minor practical importance." He then designates the particular sections which a workman will derive most benefit from, and by the study of which he can lay a good foundation for a thorough knowledge of the subject.

It can be very heartily commended to those who wish to get either a good practical working knowledge of the subject of gear wheels, or to study more deeply into the theory of this branch of mechanics.

The report of the proceedings of the twelfth annual meeting of the American Water Works Association contains papers read before the society, relating to the Brooklyn water supply; covered reservoir; distribution mains and fire service; emergency fire supply for Cleveland, O.; fire hydrants per capita and per mile of street mains; new water supply for Atlanta, Ga.; protection of exposed water mains; reservoir dams; water supply of New Orleans, and much other matter, data and discussions of great interest and value. The whole forms quite a volume, and will be an important addition to the libraries of engineers and others interested in this class of work. Copies of this report can be obtained at 50 cents each. Peter Milne, of New York City, is the secretary and treasurer of the association.

The *Locomotive Firemen's Magazine*, under the editorship of Eugene V. Debs, is constantly improving, and now compares very favorably in many respects with the best magazines published, its recent change in dress putting it in the front rank of typographical productions. Besides treating of subjects of special interest to locomotive

firemen and engineers, it publishes a great deal of very instructive discussion on the social and economic questions of the day, and is certainly doing a good educational work in behalf of the men in whose interest it is published. It is published monthly at Terre Haute, Ind.

The *Engineering News* of February 9 publishes a portrait and short biographical sketch of the life of Mr. William Metcalf, the steel manufacturer of Pittsburgh, who was recently elected President of the American Society of Civil Engineers.

Questions and Answers.

Questions of general interest relating to subjects discussed in our columns will receive attention in this department. The writer's name and address should always accompany the question. Neither correct initials nor location will be published when there is a request to that effect. If questions are enclosed with a business communication, they should be written on a separate sheet.

(75) H. W. K., Rudd, Ia., writes: Please give me the name of a book and the address of its publishers, that explains the terms used in the study of electricity; I do not understand them. *A.*—Elementary Lessons in Electricity and Magnetism, by S. P. Thompson, published by Macmillan & Co., New York.

(76) R. K., Columbia, S. C., writes: A shop in this locality has two engines in different parts of the yard; one party rents power to drive a hosiery factory and another party rents power to drive a batten mill. It is desirable to know how much power each party is using; the engines drive other machines. Can this be determined by indicator diagrams, or will it require a dynamometer? If the latter is used, how can it be applied? *A.*—The most satisfactory way will be to use a dynamometer. F. Van Winkle, 126 Liberty street, New York, supplies a kind which we believe can be readily attached. Write to him for a circular, which will show the method of attaching and using it.

(77) F. F., Springfield, Ohio, writes: Is there a rubber, or some other kind of hose, made to stand a high steam pressure, for conveying the steam from a boiler to a small steam engine? The hose will have to be bent every 15 minutes during the day. *A.*—There is a heavy steam hose made for conveying steam of a pressure as high as 75 pounds. Whether the hose will stand the continual bending for a considerable time will depend on the radius of the bend. 2. Is there some other good way of making a flexible joint to turn a square corner every 15 minutes of the day? *A.*—We believe that a good flexible joint can be made, provided the conditions are such as will not put a limit to the direction in which a pipe can be turned. Your question is too indefinite for advice.

(78) W. N. C., Blacksbury, Va., writes: Lime water gives us much trouble here in the boilers, as at many other places. Do you think that if the feed water was allowed to flow through a steam space in a receiver, in which the pressure is equal to that in the boiler, the steam being taken from the boiler, that the precipitation of lime will settle at the bottom of the receiver, and that pure water will flow to the boiler? A.—Some of the lime and other impurities will settle at the bottom, but a considerable portion of the impurities will pass to the boiler. In our opinion, this kind of purifier will not work satisfactorily. There are a number of purifiers on the market which we believe will give satisfactory results.

(79) F. R. C., Ware, Mass., writes: Can water be vaporized without allowing room for expansion; or could steam, if kept at a high temperature, be reduced to the space it occupied as water, and still be steam? Or, again, suppose we have a closed receptacle of great strength filled with water; we heat it to redness; what is the result, highly heated water or steam under an enormous pressure? *A.*—You cannot convert water into steam without leaving some room in the vessel for the steam. If the vessel is completely filled with water, no steam will be formed, even if it is heated to the highest temperature that metal can stand. If under these conditions the water is allowed to escape, it will rush out in the form of steam, and a portion of the water remaining in the vessel will at once be formed into steam of a definite pressure depending on the temperature.

(80) G. W. G., Macedon, N. Y., writes: I have always supposed that the only way to equalize the cut-off of a link motion engine was by the position of the saddle stud, as set forth in the articles by J. G. A. Meyer in the AMERICAN MACHINIST. But it would appear from Mr. Cornell's last letter that it is possible to leave the stud on the link arc and obtain the same result by the position of the tumbling shaft. Please inform me if my assumption is correct. *A.*—For equalizing the cut-off the saddle stud and the lifting shaft must be set in correct position; if either one or the other is incorrectly placed, the cut-off will not be equalized. How to determine these positions has been explained in the articles on modern locomotive construction, recently concluded in the AMERICAN MACHINIST.

(81) H. S., Provo City, Utah, writes: I have a plain slide valve engine, cylinder 12 inches diameter, 24 inches stroke, running at the rate of 130 revolutions per minute, to drive a brick machine at the same speed. Would it save fuel to reduce the speed of the engine and put on a larger driving pulley? if so, what would be the proper speed of engine? It needs only 20 horse-power to run the brick machine at 130 revolutions per minute. *A.*—The engine is much too large for the work it has to do; if in good condition it should develop three times as much power, and if it can develop 20 horse-power only there is something decidedly wrong about it, and must waste a great amount of fuel. In reducing the speed, the engine will not even then be an economical one. The best plan is to get a smaller engine suitable for the work to be performed. The saving of fuel will soon pay for the expense incurred.

(82) F. E. M., Chicopee Falls, Mass., writes: I would ask you to give me an explanation of the following problem: How can I calculate the diameter of circle on whose circumference the centers of a number of balls are placed touching each other. The inclosed sketch shows that their points of contact are not on the circumference of the circle, but they are inside of it. This sketch has been made on the cut and try plan, but I wish to know how to calculate the diameter of this circle, and also how to find the points of contact without using the cut and try plan. *A.*—The diameter of this circle is found by the rule given in answer to Question 59 in our issue of February 9th, current volume; the points of contact are found by joining the centers of adjacent balls by a straight line, the points in which these lines cut the circumference of the balls will be points of contact.

(83) Machinist, Worcester, Mass., writes: As an interested party, I wish your further opinion on Question 34, in your issue of January 26, current volume, which was not altogether whether it was possible to bore an elliptical hole with a boring-bar in an ordinary engine lathe, but rather what would be the result under the following conditions: When boring a hole in work fastened to the carriage of the lathe, and traversing past a single cutting point of a fixed cutter in a boring-bar, as is often used in shops, said bar revolving on the centers of the lathe, having the tail-stock set over and out of line of head center, but within the working capacity of the ordinary engine lathe, will the hole bored under these conditions be cylindrical or otherwise? *A.*—If the cutting point is in a plane perpendicular to the boring-bar, and passing through the point in which the axis of the boring-bar intersects the center line of lathe, the hole bored will be elliptical.

(84) J. M. H., Watertown, N. Y., writes: I am a young man of 18; I have had two years' experience in a machine shop, and now desire to learn mechanical drawing. Will you kindly inform me what would be the best course to pursue? Is there an institution where I could work, and at the same time be learning drafting? *A.*—The Michigan Agricultural and Mechanical College, at Lansing, Mich., provides for the students to work a part of the day, and pay their way almost entirely through a course of four years in mechanical and civil engineering. Write to this institution for particulars. If circumstances will not permit you to go there, then the next best course will be to go to an evening school, or take private lessons. If you cannot do this, then study at home; the papers on practical drawing, recently concluded in our columns, will aid you. Of course, in studying without a teacher more time will be required, and it will involve more mental labor, but with sufficient energy on your part, you can learn, and learn it well without a teacher.

(85) G. B., Adrian, Mich., writes: Please inform me of the best way of testing a boiler. *A.*—The following method of testing a boiler we believe to be a good one: Close all the openings in the boiler as securely as possible, but keep the safety valve open until the boiler is completely filled with water. Then, after closing the safety valve and loading it to the required test pressure, raise the pressure by means of a pump till the steam gauge indicates the test pressure. The pump should only deliver a small quantity of water at each stroke, and must be worked carefully as the pressure rises, in order to avoid jarring the strained boiler, and producing a sudden rise of pressure beyond the limit of test pressure. Some engineers close the safety valve before the boiler is quite full of water, and so retain a quantity of air to act as a cushion when the pressure is applied by the pump; but the objection to the inclosed air is, that when it escapes through leaky seams and rivets, no marks indicating such leaks are indicated on the plates. When boilers are tested by hydrostatic pressure, the water should always be hot.

(86) J. H. D., York, Pa., writes: Please give me a rule for finding the correct cross-sectional area of a smoke stack base for a return tubular boiler. *A.*—This area will depend on the amount of coal burnt per hour, and the height of the stack. When the amount of coal to be burnt is known, then refer to the table of chimney proportions in our issue of April 23, 1887, which will give the suitable diameter and height of chimney. 2. Please give lap of single and double-riveted seams. *A.*—See our issues of October 2 and 30, 1890. 3. Please give rule for finding the length of an eccentric rod before it is bent as per sketch. *A.*—This rod, after it is bent, consists of three parts—the two end parts, which are straight, and the offset, which is the hypothenuse of a right-angled triangle. The amount of offset will, in this case, be the base of the triangle, and the shortest distance between the two end parts will be the height of the same triangle. To find the hypothenuse add the square of the base to the square of height, and find the square root of the sum, the result will be the hypothenuse; add this length to the lengths of the end parts, the sum will be the length of the rod before it is bent.

(87) C. L. G., Chicago, Ill., writes: Please inform me how the formula is obtained for computing the thickness of rim of a friction wheel of cast-iron running against a similar wheel covered with paper, the web in center is to be solid (no arms). What would be the theoretical section of the rim which can distribute evenly the pressure along the surface of contact? I have had much trouble with pulleys of this kind when subjected to a strain of several tons. You will greatly oblige me by giving this information or mention some books in which I may find it. *A.*—We presume that you refer to a cone friction clutch. The angle between the axis of the shaft and the surface of the cone should be, in your case, about 20 degrees. Prof. Unwin, in his Elements of Machine Design, gives .3 of the diameter of the shaft for the thickness of the web and rim. In our issues of June 11 and 25, 1887, you will find practical suggestions and illustrations relating to the design of this kind of couplings, which, if followed, may remove the cause of your trouble. If you refer to any other kind of coupling, you will probably find the information you seek in Unwin's Elements of Machine Design, or in Weisbach's Mechanics of Engineering and Machinery.

(88) Z. S. H., Peoria, Ill., writes: Please give me a rule for finding the leverage of different screws and worms. *A.*—We presume that you want rules for finding the mechanical advantage of the screw. In any simple machine the mechanical advantage is numerically equal to the quotient obtained by dividing the resistance by the power. By the word "power" in this case we simply mean the applied force, and the force to be overcome is the resistance. Let P denote the power, say in pounds; R the resistance in pounds; p the distance in feet through which the power moves; and r the distance through which the resistance moves; we have then

$$P \times p = R \times r; \text{ or } P : R :: r : p.$$

From which we get

$$\frac{R}{P} = \frac{p}{r}. \qquad (1)$$

This formula shows that the mechanical advantage can also be computed by dividing the distance through which the power moves by the distance through which the resistance moves. These principles are also applicable for finding the mechanical advantage of a screw. Suppose the nut to be fixed and the screw to be movable. In this case the power is applied to the end of a lever. Let l denote the length in feet of this lever, then the path through which the power moves during one revolution will be equal to the circumference of a circle whose radius is l; and this circumference in feet is equal to

$$2 \times 3.1416 \times l.$$

The distance through which the resistance moves is equal to distance between threads; let us denote this distance in feet by d; now the distance $2 \times 3.1416 \times l$ will replace p in formula (1), and d will replace r; hence for the mechanical advantage of a screw we have

$$\frac{2 \times 3.1416 \times l}{d}.$$

Here, of course, friction is not taken into account.

Business Specials

Transient Advertisements 50 cents a line for each insertion under this head. About seven words make a line. Copy should be sent to reach us not later than Saturday morning for the ensuing week's issue.

Grant's Gear Advertisement is always on page 11.

Shafting Straighteners. J. H. Wells, Tampa, Fla.

Ideal Drawing Stands. M. C. Hammett, Troy, N. Y.

Forming Lathes Mer. Mach Tool Co., Meriden, Ct.

Tool Holder: Armstrong Bros. Tool Co., Chicago.

Norway Rivets. Evans & Robertson, Cincinnati, O.

"Bradley's Power Hammers, the best in the world." 20 sizes. Bradley & Co., Syracuse, N. Y.

Pattern and Brand Letters. A variety of sizes and styles. Heber Wells, 8 Spruce St., New York.

Drill Presses, with Tapping Attachments.
Gould & Eberhardt, Newark, N. J.

Davis Key Seating Machines kept in stock by Manning, Maxwell & Moore, 111 Liberty St., N. Y.

Selden Packing for stuffing box, with or without rubber core Randolph Brandt, 38 Cortlandt St., N Y.

Model work and gear cutting done by M. C Henley, Richmond, Ind.

Pulley lathes, most efficient offered. The Lodge & Shipley Machine Tool Co., Cincinnati, O.

Engine Castings, Humphrey's Foundry, Bellefontaine, O.

For Cypress Tanks and Vats, address W. E. Caldwell Co., Floyd and Main Streets, Louisville, Ky.

Guild & Garrison, Brooklyn, N. Y., manufacture steam pumps, vacuum pumps, vacuum apparatus, air pumps, acid blowers, filter press pumps, etc.

"Shapers (Double Triple Quick Stroke")
Trade Mark.
Gould & Eberhardt Newark, N. J.

For the Latest Improved Diamond Prospecting Drill, address the M C. Bullock Mfg. Co., corner Canal and Washington Sts., Chicago, Ill.

Combination, duplex and special gear cutters in stock and to order. R. M. Clough, Tolland, Conn.

Roper's Practical Handy-Books for Engineers & Firemen; Descriptive Catalogue mailed free. Edward Meeks, Pub., 1012 Walnut St., Philadelphia, Pa.

Gear Cutters, Auto. Specially adapted for Motor Gears and all other style Gears.
Gould & Eberhardt, Newark, N. J.

S. W. Card & Co., Mansfield, Mass., are putting on the market a new line of stocks and dies, with their patent adjustable dies and guide. S. A. Smith, 23 S. Canal Street, Chicago, Ill., Western Agent.

Patent Soliciting of High Class.
D. Walter Brown, Counsel in Patent Cases,
31 Nassau Street, New York.
Send for Brief History of Patent Legislation.

De Lamater Screw Propeller Wheel, made only by The Samuel L. Moore & Sons Co., Elizabethport, N. J., who have purchased from C. H. De Lamater & Co., New York, all their patterns, books of record, gauges, etc. Location and equipment well adapted for Heavy Steamship Repairs.

"Binders" for the AMERICAN MACHINIST. Two styles the "Common Sense," as heretofore sold by us, and mailed to any address at $1.00 each, and the "New Handy," mailed at 50c. each. The former has stiff board covers, while the latter has flexible covers with full page opening flat. Either will hold the entire 52 issues of any volume. AMERICAN MACHINIST PUBLISHING CO., 203 Broadway, New York.

"Indicator Practice and Steam Engine Economy." By F. F. Hemenway. Contains plain directions for using the indicator and making all required calculations from the diagram, also the principles of economy in operating steam engines and current practice in testing engines and boilers. Price, $2 postpaid. Published by John Wiley & Sons, 53 East Tenth Street, New York.

Guess and Try in a Machine Shop.

BY A MECHANIC.

It is not my object this time to tell of the guess and try way when carried to extremes, like the man who, in dividing a circle into say 101 parts, sets his dividers by a guess, based upon nothing but a hope of luck, and then spaces around the circle several thousand times, or until he meets with an accident; but the every-day cases, which through long usage have come to be thought of as the correct and perhaps only way. There is a great chance for improvement in calipers, and also in using them. They are about the first tools that a new apprentice is introduced to (in shops where the broom exercise is omitted), and as long as he works at the business he will have no opportunity to forget them, so if there is a chance for improvement it should be worth every machinist's attention.

The plain every-day calipers, as commonly used, are first rate to measure work with after the work is finished, but before the size is found they show nothing to speak of, except that the work is not right. This holds true with solid gauges, and altogether too many tools used in a machine shop. When we measure a length with a graduated rule, we take notice besides that it is not correct, how much it differs; this is exactly what calipers should be able to show. If the work is not correct, we want to know how to make it so, or the most direct

way to make it so. The micrometer caliper seems to cover the ground for an ideal tool, and I believe I shall live to see the day when, in most well-conducted machine shops, they will be used for fine measurements, both on large and small work. The micrometer caliper has got a strong hold now on small work; but on large, where it should be of equal value, it is quite unknown. Many machinists when they hear of using micrometer calipers, and of measuring to a thousandth of an inch, seem to get the idea that extreme fineness is meant, and that the tool itself is difficult to understand. Now this is not the case, the micrometer caliper simply measures in fractions of an inch those "*littles*," "*strongs*," "*fulls*," "*hairs*," or amounts so small that with the common calipers guessing must be resorted to. When a workman is told to reduce a fit just a "*hair*," he will know what is meant, if he has been following the job closely. If he has himself tried to get the work together, and has seen for himself how tight it is, then he will know about how much is meant by a "*hair*" in this case. A "*hair*" as a unit of measurement is a very uncertain amount.

If you are told to chop "*just a hair*" from the length of a fence rail, you might safely cut off about 6", but if you are told to remove .002", it would mean exactly the same thing, whether from the diameter of the finest needle, or the length of a building.

Beside this advantage I have described, and which is the one most in gear with my subject this time, the micrometer caliper is in itself a complete set of standard gauges, running by thousandths to the extent of its range.

A great many in using a micrometer caliper do not use it so as to realize its full value. They will set it to the size required, and then use it as a solid gauge. This way it possesses no value over common calipers, except that it can be set independent of any other gauge. To receive its full value, screw it up carefully upon the work, which will show the size of work, and then you can know what must be done to make it right.

A carpenter measures the length of a board, and draws a line to saw to; but a machinist, I am sorry to say, in a great many cases does what would be equal to measuring the board, and then guessing what to take off, after which he measures and guesses again, and so on till he gets it right.

This is in cases where it is not practical to work to a line, and it is done for want of a better way. I have just pointed out a way to know what remains to come off, but after this we want to know some direct way to take it off without guessing. This can be done on machine work in most cases by providing graduated dials on all machine feed screws, and then getting used to using them.

For rough measurements, or to within 4 or 5 thousandths of size, the old-fashioned friction calipers used by just pushing them over the work, and then measuring them with a steel scale, is very good after you get used to the way, but for fine work the micrometer caliper is the coming thing.

I have no doubt but that a great many will say to this, "Oh, bosh, that will do for a man of theory, but a man with practical experience does not need anything of this kind. We will admit that we do guessing, but it is skilled guessing. Long practice has made us pretty good at our way of working." Now this is good from this point of view, but if long practice makes men good at a bad way of working, how much better will they be with the same amount of practice at a better way? I use this improved way of working or of measuring wherever I think it practical. In many cases where I do not think it practical to measure with scale or caliper, I find it a great advantage to be able to judge distances by the eye closely, which forms a good base for guessing. For instance, if I am truing a wheel on a lathe face-plate, I try to judge about how much it runs out, and then sometimes stick a wooden plug into a slot in face-plate, swinging one end in contact with the wheel before moving, so that I may know how much it moves at a blow.

I find it a better plan, in most cases, instead of running the work and chalking it, as grandfather taught us to do, to just divide the wheel or face-plate into four about equal divisions, by chalk marks, and then use the point of a tool held in the tool-post, or the needle of a surface gauge resting upon the wing of carriage, to indicate when two opposite sides of wheel are equally distant from center of spindle, after which center the two sides at right angles.

In using the center indicator, I want to know how much it magnifies, so that I can form some kind of an opinion of how much the work is out of true, and when it is true enough.

We should not shoot our guns at perfection when we know there is no chance for success, and even if so, we would have no use for the game.

I showed a center indicator some time ago in the AMERICAN MACHINIST, designed as an improvement on the center ring kind, on account of its showing correctly the amount the work is out of true, besides when it is true. Mr. Gribben, in your issue of Feb. 2, shows a way to make a spring tool for use with the old pattern indicator, which covers the same ground, and in some respects makes a better tool. The old style ring center indicator, used in combination with the shank of any old lathe tool with a center punch mark upon it, would show when the work is true, and in the hands of a man who believed in everlasting guessing and final perfection and an eternity of time, it seems the proper thing in a proper place.

I have great faith in a good thing receiving its share of attention when it becomes known.

Sometimes it requires a long time for a new thing to manifest its value to people generally, but it gets there in time. There are two things I expect to see better introduced into machine shops than now; I have mentioned them in this letter—the micrometer caliper, and the graduated dials on machines.

There is one thing that I expect to lose sight of a great deal—that is, guessing in a machine shop.

Pure Emery—Rope-driving.

BY W. H. BOOTH.

There has been a good deal written of late upon emery wheels. I should be glad if some reader of the AMERICAN MACHINIST could tell me where I can obtain emery in a coarsely ground state in a state of practically absolute purity. Probably all who use emery know that it is very largely adulterated with iron, which is present in a peculiar apparently slaggy condition, but magnetic. Now I want some pure. Where can it be obtained?

In the notes on "Rope-driving," by M. E., reference is made to the increased friction due to wedging in the grooves. There may be some loss due to this wedging action, but I think a far greater source of loss is due to the deeper wedging of one rope as compared with another, so causing them to grip upon a different circumference. A soft rope will probably sink in deeper than a hard one. Now when wire ropes are used, covered with leather, the leather being applied in the form of washers threaded on the rope, it is customary to run such ropes in round-bottomed grooves. Every rope runs, therefore, upon an equal circumference, and there can be neither loss from wedging nor from unequal slip. The question arises: has it been yet clearly proved that ordinary fibrous ropes will not work satisfactorily in semi-circular grooves, such grooves not being quite as wide perhaps as the new rope, but sufficiently narrow to give some side support to the rope, and prevent it flattening out under a heavy pull? Forty-five degrees is a very usual angle in English practice, but I have seen even sharper angles used, and I have seen plain round-bottomed grooves used for the leather-covered ropes above described; and I have seen square leather ropes running in grooves which had been made for round rope, and made no pretense at fitting the ropes, which clung variously to either side of the groove, and also did not keep one side only in contact, but ran more or less twisted with apparently no difficulty. Indeed, I believe leather ropes suffer less frictional loss than any other. Any way, I am inclined to believe that fibrous ropes would have grip enough in most cases without the assistance of the wedge groove.

As regards the amount of sag on the slack side, I have seen this allowed to grow until the slack sides hung so closely to the driving sides as to call for tightening up, and there has been no slip. In such cases the driving pulley would be about 30 feet diameter, and the driven pulley perhaps 4 or 5 feet.

Whence arise the silly paragraphs about new inventions to accomplish objects which have been long since common property? Take the one you notice editorially about conical pipe threads or threaded ends. The system is years old, and now is trotted out as new. In all the best pipe work the ends are so threaded that the pipes tighten home in their sockets a hard fit, just as the pipe ends butt together in the middle of the socket, which gives a double security against leakage, and a perfectly continuous and smooth interior, free from the gap which exists in ordinary socket joints. Without the coned end, joints of a strength equal to the body of the pipe, or practically so, could not be obtained.

Boiler Feed.

Engineer J. H. Jones, of the North Pacific Coast Railway steamers, when having the boilers of the steamer "San Rafael" overhauled last year, had a kind of pocket built on the inside of the main shells at one side, into which the feed water is pumped, and from which the sea blow-off leads out. This pocket consists of a sheet about 3 feet wide flanged at the sides, and riveted to the main shell inside, leaving an annular space around the side of the boiler, 30x2¼ inches, the top or overflow being a little higher than the flues. The area of this chamber being about forty times that of the feed pipe, the water injected rises slowly, is thoroughly heated, and precipitates nearly all of any mineral substance it may contain before reaching the main body of water in the boiler. Several times each day the blow-off valve is opened for ten seconds or so to keep this intake chamber clear. A hand-hole is provided for inspection, and the cost of the whole was about $35 on each boiler of 300 horse-power. The idea is neat, effectual and inexpensive.—*Industry.*

Petroleum Burner Patent Decision.

A decision has been rendered by the U. S. Circuit Court in the suit of the Aerated Fuel Company, of Springfield, Mass., vs. Cox & Sons Company and others, sustaining the patent granted to Mr. Bullard, of the Aerated Fuel Company, February 5, 1889, and covering all apparatus for burning hydrocarbon liquid in the presence of compressed air when the liquid and air are supplied to the burner through separate conduits, and the degree of compression of the air is automatically regulated.

Temperature Observations on the World's Fair Buildings.

E. C. Shankland, M. Am. Soc. C. E., Chief Engineer of the World's Columbian Exposition, has during the recent severe cold weather been watching the effect of temperature on the arches in the Manufactures and Liberal Arts building. When the roof was designed no allowance was made for temperature strains. Mr. Shankland states:

"On Sunday, January 15, when the temperature was 20 degrees below zero, we found the center pin of the arch observed, which you will remember is 206 feet from the floor, was 5¼ inches lower than when it was erected last June, and the ridge of the roof, about 1,200 feet long, had shortened 4 inches. The arch at the north gable has leaned 2¼ inches south, and that at the south gable 1⅞ inches north. Although there is such a great amount of skylight in the roof, yet we have not found a single pane of glass broken owing to temperature strains in the iron. I intend to take daily observations during the summer on the roof, and if I am able to, will have some quite interesting data when the Exposition closes."—*Engineering Record.*

MANUFACTURES

We intended to say in a previous issue that Maris & Beekley, of Philadelphia, succeeded to the business of The Maris Machine Co., October 1, 1892.

It is reported that Mr. Todd, of St. Stephen, Me., in company with Massachusetts capitalists, will build a pulp-mill on the St. Croix the coming summer.

The Bickford Drill Co., of Cincinnati, O., have changed their name to the Bickford Drill and Tool Co., and Mr. Anton Mill and August H. Tuechter have been admitted as partners.

The Superior Machine Works, of Cleveland, O., has been superseded by "The Superior Machine Co.," which was organized under the laws of Ohio recently, with a capital of $25,000.

We have received from Henry R. Worthington, New York, a special catalogue of the Worthington water meter. As its title indicates, it is devoted especially to illustrations and the description of an improved water meter, to be used in connection with any water-works or other hydraulic service.

Mr. Chas. J. Prankard, who, until recently, has been foreman of the Tolhurst Machine Works, of Troy, N. Y., has resigned that position, and has started a machine shop in the Bascom Building, cor. River and Hoosick streets, that city, in which he proposes to do jobbing and other machine work.

We have received the 1893 catalogue of the American Hoist and Derrick Co., of St. Paul, Minn. It contains a great many illustrations of a large variety of hoisting machinery, including engines, derricks, etc., adapted to a variety of uses in quarrying, mining and building operations. There is also much information which is of practical utility to those connected with such work. The catalogue is well printed, well arranged, and well illustrated.

One of the most elegant publications we have seen recently is that of Westinghouse, Chuck, Kerr & Co., of New York. It is entitled "A Modern Boiler Plant," and is devoted to a description of what is thought to be very nearly the ideal building for and arrangement of boilers and their accessories. The subject of the pamphlet is a plant designed and constructed for Curtis, Davis & Co., of Cambridgeport, Mass., and it will be found of great interest to those who are interested in steam plants.

The National Wood Carving Company, whose annual meeting was recently held at Lewiston, Me., have nearly completed preparations for the removal of their plant from Lynn to that city. They are now manufacturing machines at their works in Lynn, and will soon have enough completed to fit up their establishment in Lewiston. The officers of the company are as follows: President, C. I. Barker; treasurer, Frank W. Parker; clerk, D. J. Callahan; directors, C. I. Barker, J. L. H. Cobb, D. J. Callahan and J. H. Stetson, of Lewiston; J. B. Hunton and H. W. Merrill, of Auburn; E. L. Goding and L. A. Goudy, of Portland; Fred. Snow, of Lynn.

There is water-works agitation at DeKalb, Ill.; Elyria, O.; Asheville, N. C.; Portland, Ore.; Arkansas City, Kan.; Portsmouth, O.; Brownsville, Tex.; Babylon, L. I.; Kenosha, Wis.; Atlanta, Ga.; Portland, Ore.; Madison, Wis.; Covington, Ind.; St. Albans, Vt.; Hoboken, N. J.; New Berne, N. C.; Spokane, Wash.; Center Brunswick, N. Y.; Lawrenceburg, Ky.; Hanover, Mass.; Cincinnati, O.; Schenectady, N. Y.; Greenville, O.; Norwalk, O.; Menominee, Wis; Sharon, Pa; Tyler, Tex.; Ft. Worth, Tex; Danville, Va.; Sherman, Tex.; Roanoke, Va.; Laramie Wyoming; Sechelt, B. C.; Racine, Wis.; Findlay, O.; Mansfield, O.; Sandusky, O.; Rochester, N. Y.; St. Helen, Ore; Yonkers, N. Y.; West Troy, N. Y.; Holyoke, Mass.; Hicksville, O.; Jewett City, Conn.

One of the finest and most complete catalogues that have been issued for a long time, is "Catalogue No. 5," which has recently been issued by the Hilles & Jones Co., of Wilmington, Del. It is a large cloth-bound catalogue of 170 pages, devoted to illustrations and descriptions of a very complete line of punching, shearing, bending, riveting, and other plate working machinery, such as is used in boiler shops, shipyards, etc. There are also illustrations of heavy vertical milling machines, gang drilling machines, radial drilling machines, and many special appliances which are used in connection with the machines above referred to. In quality of paper, printing, illustration, binding, convenience of arrangement, etc., this catalogue

is a very exceptional one. It is, of course, too expensive a book to be "sent on application," but, we have no doubt, may readily be obtained by those who are at all likely to be in need of such machinery as is described in it.

The New England Sulphite Digester Company has been organized, with a capital stock of $500,000, and the following list of officers: President, N. M. Jones· treasurer, Charles Curtis; directors, George E. Keith, of Campello, Mass.; Thomas B. Draper, of Canton, Mass.; James S. Turner, of Rockland, Mass.; Charles Curtis, of Newton, Mass., and N. M. Jones, of Howland, Me.; clerk, Clarence Hale, of Portland; secretary, Charles Curtis. The company is entitled by its articles of incorporation to manufacture sulphite wood fiber, and deal in the same and all other kinds of fiber, wood pulp, paper, wood board, and all other similar products and incidents thereof, including machinery, tools and all necessary supplies. The president of the company, Mr Jones, is the present manager of the Howland Falls (Me.) pulp-mill. The company hold the patent rights of the new digester lining and other improvements invented by Mr. Jones, which have proven so successful at Howland Falls, and it is their intention to establish a large pulp and paper mill on the Penobscot in the near future.

What will henceforth be undoubtedly the largest wood working machinery manufacturing concern in the world, will be formed by the combination of J. A. Fay & Co. and the Egan Co., both of Cincinnati, O. The directors of the new company will be Thomas P. Egan, Frederick Danner, W. H. Doane, D. L. Lyon, David Jones, W. P. Anderson, Joseph Rawson, S. P. Egan, and Edwin Ruthven. Thomas P. Egan will be president; Mr. Danner will be vice-president; S. P. Egan, superintendent, and Mr. Ruthven, secretary. These four officers are of the Egan Company. The shops of the two companies are at present quite near each other, and are to be united by bridges crossing the streets of the city, so that they may be operated as one establishment, no other changes of importance being likely to take place in the shop operations, except such as may be desirable in the way of re-arrangement and classification of the work. The J. A. Fay Co. is one of the oldest, if not the oldest company in its line in this country, the original shop having been started at Keene, N. H., about 1835. The Egan Co. was formed in 1873, and has, since then, rapidly grown to be one of the largest of the kind in the country. The combination will take place March 1st.

Machinists' Supplies and Iron.

NEW YORK, February 18, 1893.

Iron—American Pig—We quote Standard Northern brands, No. 1 Foundry, $14.75 to $15.25; No. 2, $14 to $14.50; Gray Forge, $13 to $14. Southern brands of good quality are obtainable at $14.75 to $15 for No. 1 Foundry; $13.75 to $14 for No. 2; and $12.75 to $13 for Gray Forge.

Scotch Pig—Coltness is quoted at $21.75; and $20 for Eglington.

Antimony—The market is steady. We quote L. X., 10¾c. to 10½c.; Cookson's, 10½c. to 10¾c.; Hallett's, 9⅞c. to 10c., and U. S. French Star, 10½c.

Copper—The market is unchanged Lake Copper is quoted at 12.10c. to 12¼c. Only immediate wants are being supplied at the easy prices. Casting Copper is held at 11¼c. to 11½c.

Lead—The market is stronger. Offerings are more reserved, and bids of 3.92½c. to 3.95c. are not accepted. Sellers are asking 4c. and above, but without attracting business.

Lard Oil—Prime City is quoted at $1.05 to $1.06; Western on spot at $1.04.

Spelter—The market is easy at 4.30c. asked, and 4.25c. bid.

Tin—The market is steady. Sales are reported of 25 tons February at 20.10c., and 125 tons March at 20.10c. to 20.15c.

WANTED

"Situation and Help" Advertisements only inserted under this head. Rate 30 cents a line for each insertion. About seven words make a line. Copy should be sent to reach us not later than Saturday morning for the ensuing week's issue. Answers addressed to our care will be forwarded.

Wanted—Salesmen on commission, to push a special line of mach'y. "Kirk," care of AM. MACH.

A first-class draftsman wants situation; machine tools a specialty. Address Box 15, AM. MACHINIST.

Designer and draftsman, technical graduate, with shop exp., wants position. Box 24, AM. MACH.

Designer and constructor desires engagement in either capacity, or both. A. O., AM. MACHINIST.

Wanted—First-class tool makers and machinists at good wages; steady employment. State age and exp. American Engine Co., Bound Brook, N. J.

Wanted—Position as traveling salesman, by practical machinist (American); good worker; 2 years on the road. Box 98, AMERICAN MACHINIST.

Wanted—Draftsman who has been with Brown & Sharpe or Pratt & Whitney. State age, salary, and experience. E. C. M., AMERICAN MACHINIST.

Wanted—A good mechanical draftsman, one who has worked on printing press machinery preferred. State exp. & wages expd. Box 23, AM. MACH.

A mechanical engineer, with 15 years' experience in shop, drawing room and business, desires a position in or near New York. Address E., P. O. Box 1167, New York.

Wanted—A mechanical draftsman familiar with tool design to get up fixtures, jigs, etc., in a steam engine manufactory; must be a mach't. Address with refs. and exp., Draftsman, AM. MACHINIST.

Wanted in Penna. a foundry foreman who is accustomed to heavy engine work; only 1st-class man one acquainted with modern methods, need apply; give experience, references and wages expected Address Foundry, Box 18, AMERICAN MACHINIST.

Wanted, immediately—Competent foreman for machine shop working 25 men; small engine work; permanent position to competent man who is a hustler. Address, stating wages expected, experience, etc., Machinist, Lock Box 324, Chicago, Ill.

Wanted—A foreman in machine shop of an engine manufactory; must be familiar with modern jig and gauge methods, and a pusher; a good place is open for the right man; references will be investigated. Address Ohio, care AM. MACHINIST.

Mechanical draftsman, good designer, shop practice, exp. in general & power transmission mach'y, wants steady employment. Box 25, AM. MACH.

Wanted—Good monitor hand in shop doing general machine work. Must be capable of taking charge of three or four other lathes. Address, stating experience, present position, and wages expected. Turret, Box 22, AMERICAN MACHINIST.

Wanted—Position as manager or sup't, by a man with experience in shop, drawing room and business, who knows the value and importance of system, method, discipline and economy to reap dividends, and can practice his preaching. Address Engineer, care AMERICAN MACHINIST.

Wanted—Foreman for machine shop, mfg coal hoisting, hauling, elevating, conveying, screening and ventilating machinery, beside a large jobbing trade. Must be familiar with this class of work, a good manager of men, and have the ability to produce work to meet competition Perm't pos to right party; ref. Eagle Iron Works, Terre Haute, Ind.

Wanted—By a mechanical engineer, position as supt., head draftsman or erecting engineer. Exp. in designing, testing, running and erecting of steam engines, refrigerating mach. and steam pumps; also locomotive and heavy ordinance, ec nomical installation of steam & power plants for electric light and railways, etc. Engineer, Box 21, AM. MACH.

Wanted—An office man, one who has some exp. in a machine shop & foundry; must be a good penman and have a good knowledge of book-keeping; must be competent to make records of patterns, other office duties, etc.; none but first-class men need apply, giving experience, references and wages expected; no objections to a young draftsman of some experience. Address BOX 16, AMER. MACHINIST.

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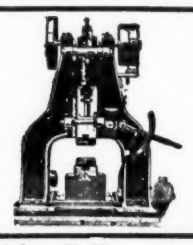
Meet all requirements more fully and satisfactorily than any other of its competitors.

INVESTIGATION IS NOT COSTLY.
INVESTIGATION IS CONVINCING.



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If you plate, draw, square, taper, swage, collar, spindle, or do any manner of die forging in iron or steel, a BRADLEY HAMMER will soon pay for itself, by what it will save over any other similar tool. Send for circulars.

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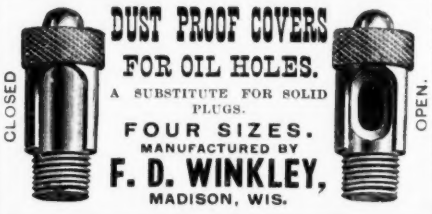

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SOFT GRAY IRON CASTINGS.

From ⅛ oz. to 1000 lbs. Small Castings a Specialty. Light machinery wanted to build.

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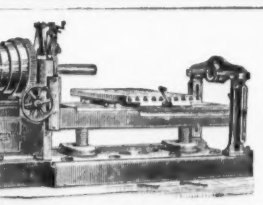

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IMPROVED PATTERNS! LATE DESIGNS!

THE MASON PUMP PRESSURE REGULATOR.

For fire, tank, elevator, air and water works pumps, or any class of pumping machinery where it is necessary to maintain a constant pressure. The regulator may be instantly adjusted to any pressure desired by simply turning the key as shown in the cut.

The especial feature of this regulator is that the pressure chamber into which the water enters is entirely removed and separate from the steam and all working parts.

The long cylinder at the bottom of the regulator is a dashpot, the piston of which is connected with the main valve of the regulator, thereby preventing sudden and violent "jumping" of the pump when the pressure suddenly changes.

For automatic fire sprinkler service they have been found especially valuable, as the valve is thrown wide open immediately the slightest drop in pressure occurs. On application we can refer parties where they are in use.

These regulators are made in all the pipe sizes; those up to and including two inch, of the best steam metal, the largest sizes of cast iron lined with steam metal. The springs are made of the finest tool steel, tempered.

MASON REGULATOR CO., Boston, Mass., U. S. A.

ASBESTOS CEMENT FELTING,

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Samples and Descriptive Price List Free by Mail.

We are prepared to take Contracts for applying Steam Pipe and Boiler Coverings in any part of the United States.

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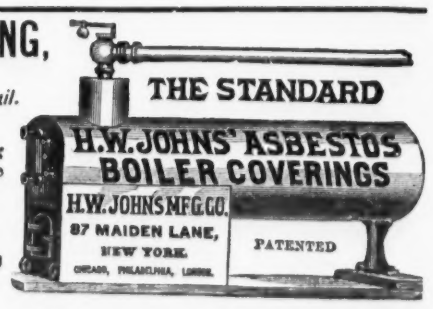

✲WANTED✲

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Wanted—A foundry foreman, who is accustomed to general foundry work, including engine cylinders and castings of large and small size, car and building castings, in a foundry employing about 60 molders; applicants must be well up in dry sand and loam work, and understand irons and the most economical methods of melting, and be thoroughly familiar with piece work; none but first-class men need apply; state age, experience, and salary required; a good salary will be paid to the right man. Address X. Y., BOX 13, AMERICAN MACHINIST.

✢ MISCELLANEOUS WANTS ✢

Advertisements will be inserted under this head at 35 cents per line, each insertion. Copy should be sent to reach us not later than Saturday morning for the ensuing week's issue. Answers addressed to our care will be forwarded.

Cheap 2d hd lathes & planers. S. M. York, Clev'd, O.

Best Steel Flue Scrapers. Kelley Co., Erie, Pa.

For Sale—Second-hand drill presses, engine lathes and planers. Dietz, Gang & Co., Cincinnati, O.

Light and fine machinery to order; Foot Lathe Catalogue for stamp. E. O. Chase, Newark, N. J.

Engines, special and gen. mach'y designed; ideas developed. A. W. Jacobi, 136 Liberty St., N. Y.

Best Bolt Header in the world for $50. Address C. H. Baush & Sons, Holyoke, Mass.

Wanted—Hardware specialties to build. Send 25 cents for "Eureka Knife and Shears Sharpener." W. A. Smith & Co., 227 Eddy St., Providence, R. I.

Wanted—Special and Experimental Machinery, to manufacture by the Henley Machine Tool Works, Richmond, Indiana.

For Sale—A machine shop, well established in a city in Central Pennsylvania. Price, $3,500. Want inquiries from parties meaning business. Address P. O. Box 27, Harrisburg, Pa.

Special, experimental or other light machinery manufactured. Best equipped shop in the West for fine work. Manufacture one of the best hollow spindle bench lathes for the tool room or for manufacturing. Write us. Moseley & Co., Elgin, Ill.

We will pay 50 cents each for copies of the AMERICAN MACHINIST of Jan. 15th and 22d, 1881; Jan. 7th and 21st, 1882; and Dec. 25th, 1886, issues. Must be unsoiled and in good condition. AMERICAN MACHINIST PUBLISHING COMPANY, 203 Broadway, New York.

DESIRABLE SECOND-HAND MACHINERY.

LATHES.

1 15 in. x 5 ft. Windsor, Rise and Fall Rest.	A1 condition
1 17 in. x 6 ft. Fitchburg, Compound Rest.	A1 condition
1 16 in. x 7 ft. Bement, Plain Rest, heavy fine Tool.	A1 condition
1 17 in. x 8 ft. Blaisdell, Rise and Fall Rest.	Good as new
1 13 in. x 4 ft. Prentice, Plain Turning Lathe.	A1 condition
2 10 in. x 3½ ft. Garvin, Hand Lathes.	Good as new

PLANERS.

1 30 in. x 30 in. x 8 ft. Hewes & Phillips, one head on rail, a fine modern Tool.	Good as new
1 40 in. x 36 in. x 10 ft. New Haven, one head, a heavy Tool.	Good order
1 37 in. x 40 in. x 9 ft. Enterprise Machine Co., one head.	Good order
1 24 in. x 24 in. x 6 ft. Pease, one head.	A1 condition
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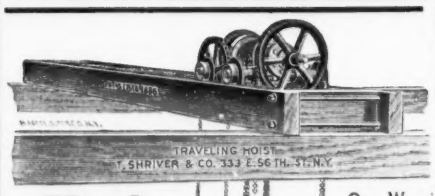

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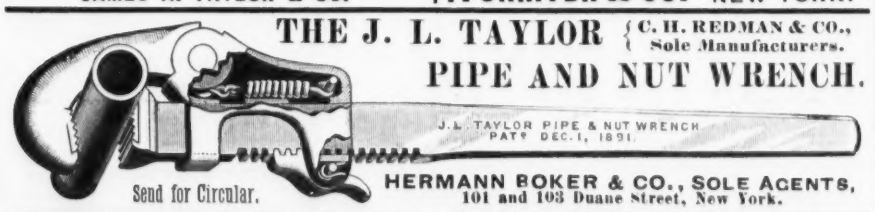

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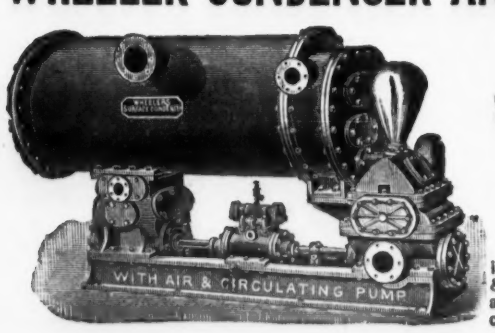

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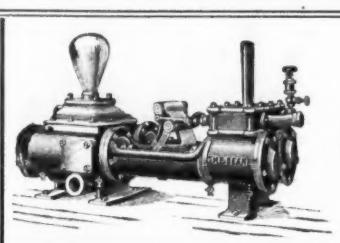

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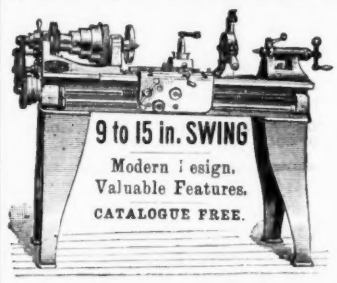

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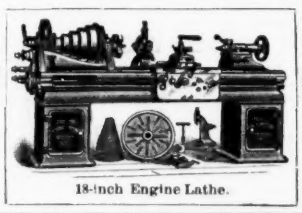
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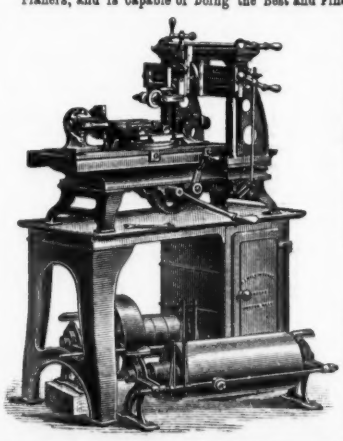

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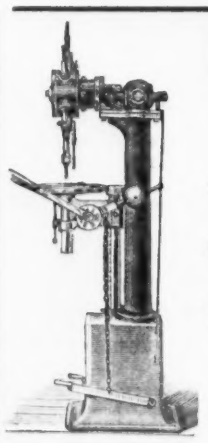

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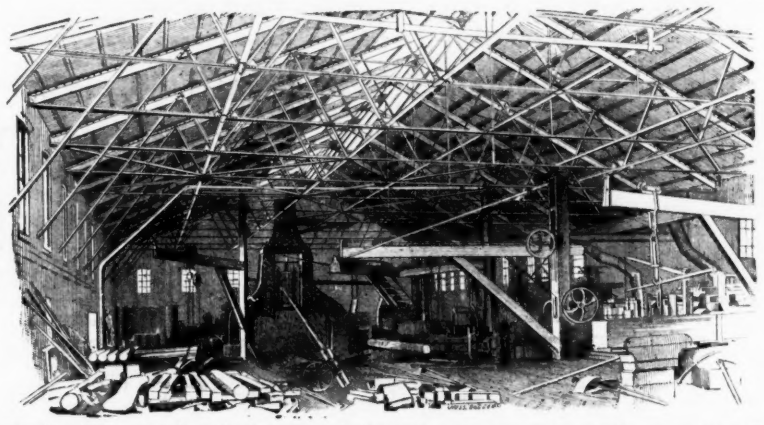

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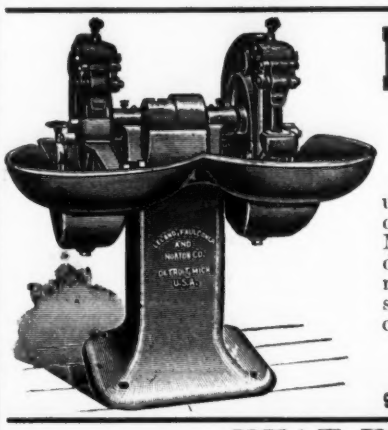

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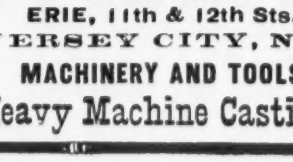
Send for  Circular.

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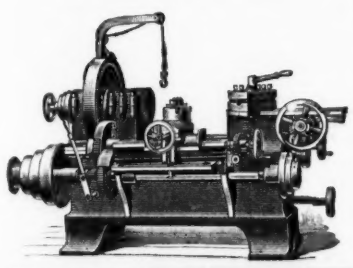

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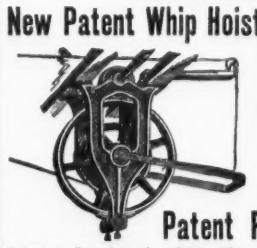

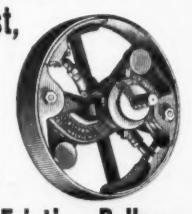

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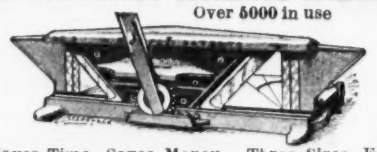
ORIGINAL  IMPROVED

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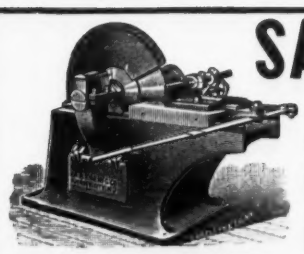

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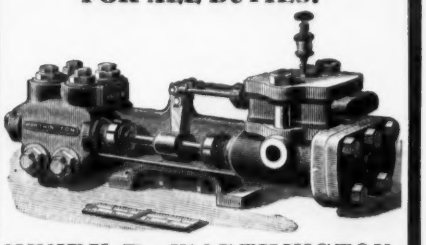

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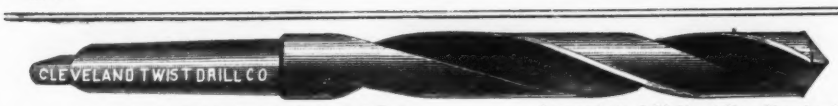

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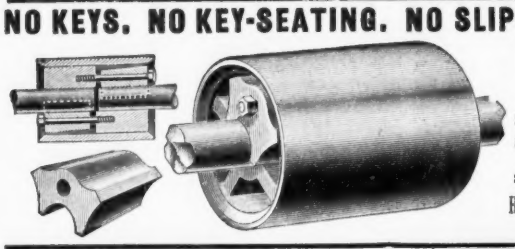

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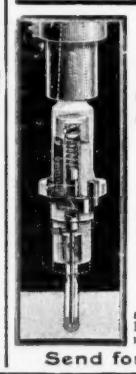

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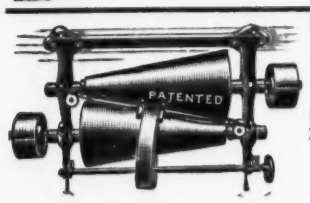

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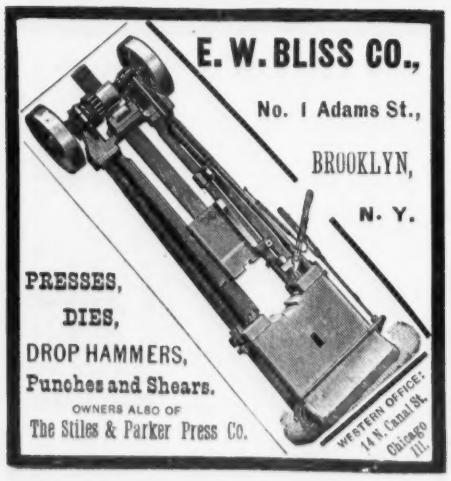

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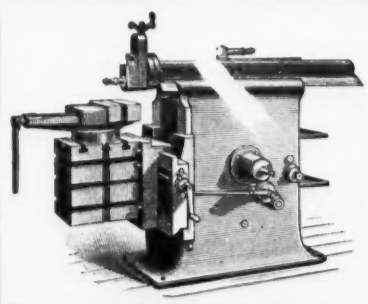

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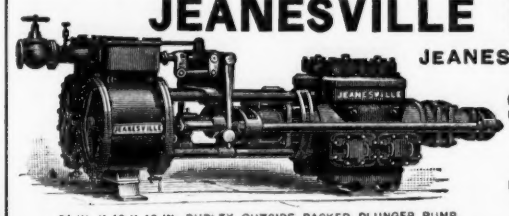

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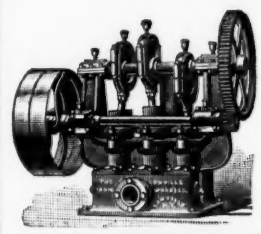

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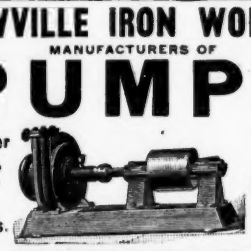

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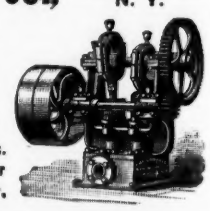

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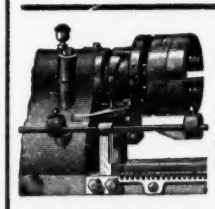

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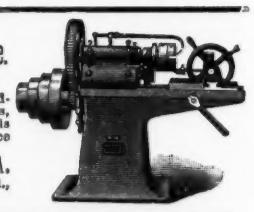

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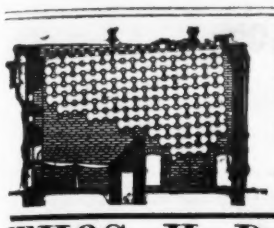

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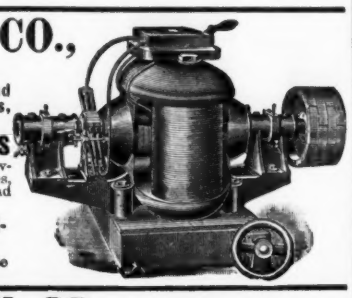

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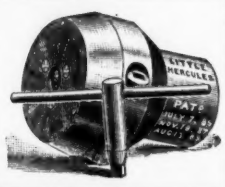

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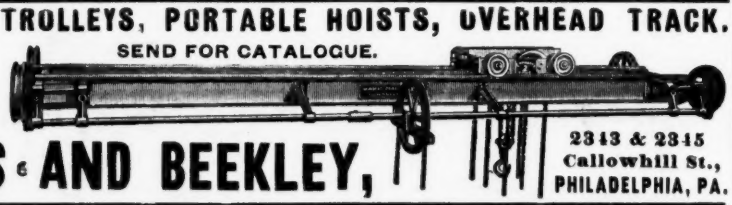

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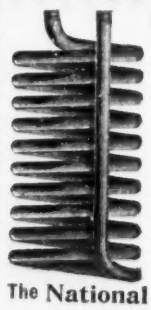

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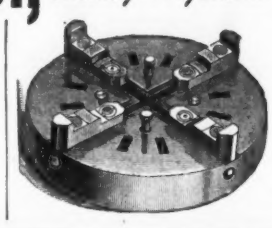

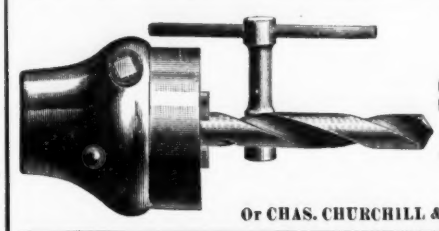

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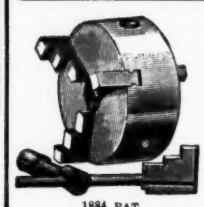

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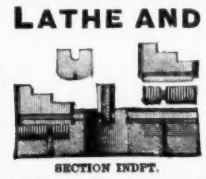

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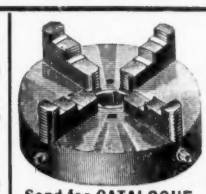

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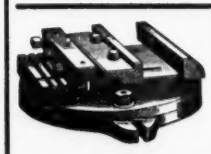

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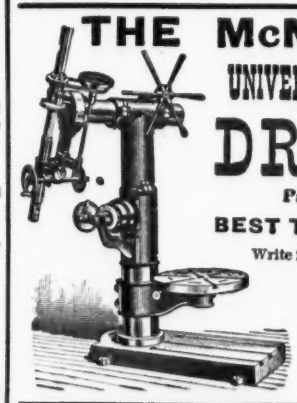

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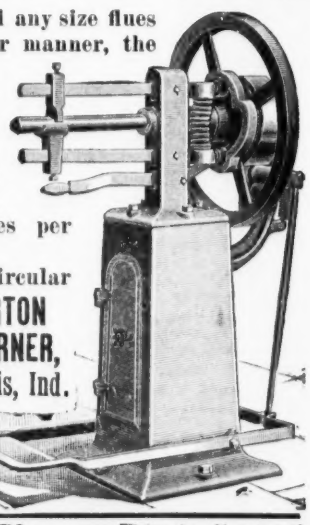

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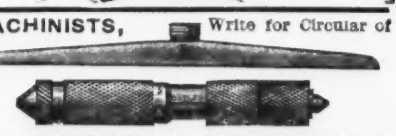

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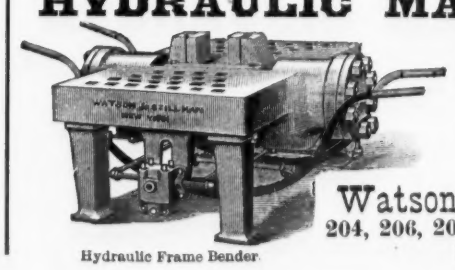

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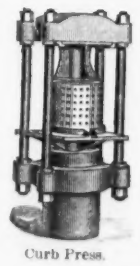

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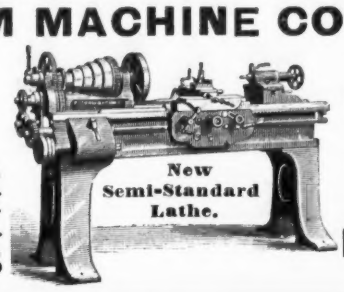

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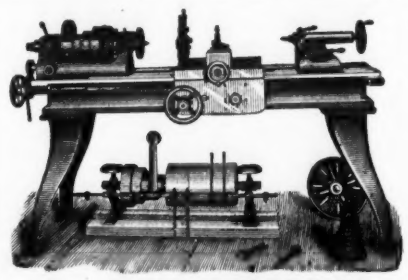

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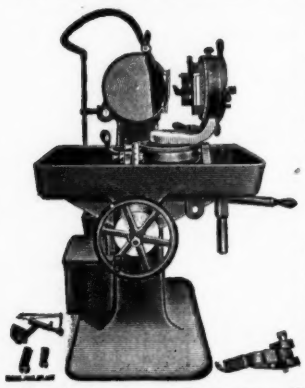

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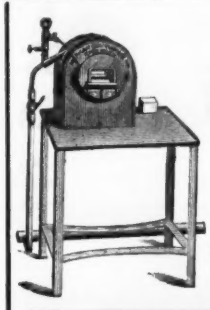

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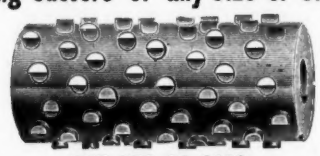
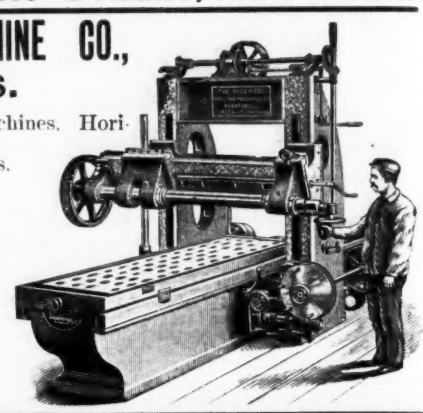


PAT. DEC. 24, 1889.



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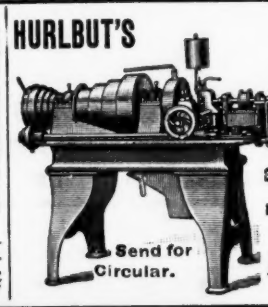

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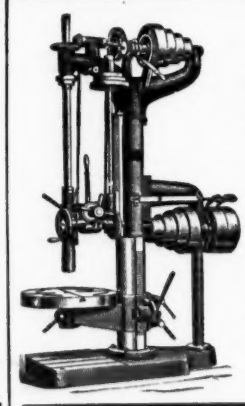

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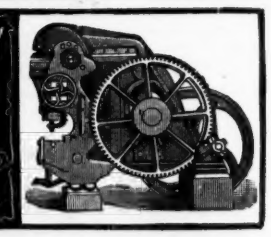

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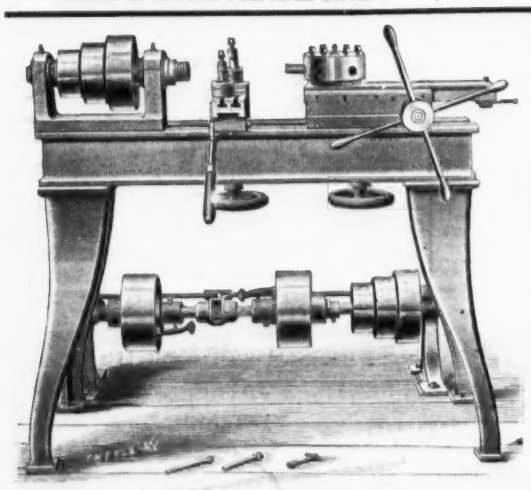

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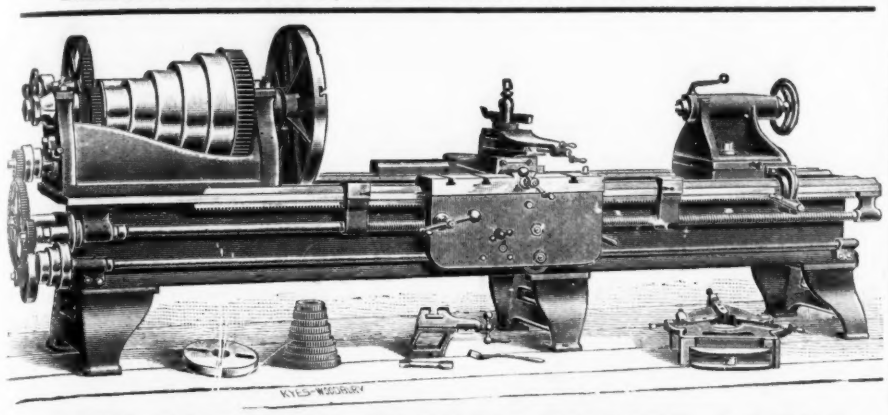

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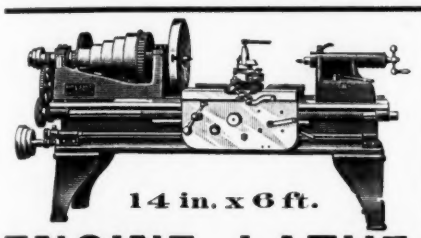

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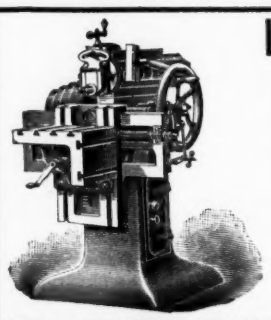

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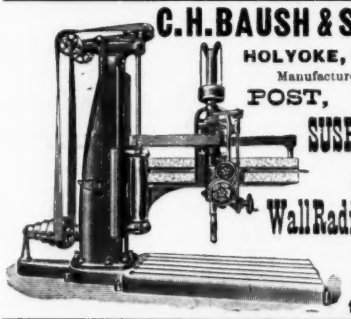

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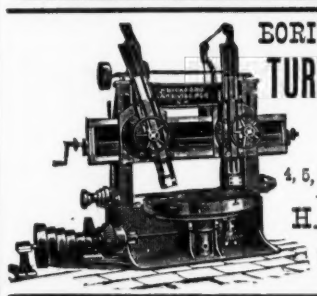

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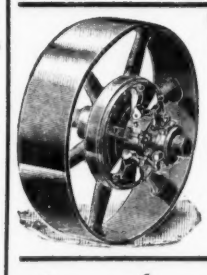

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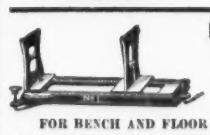

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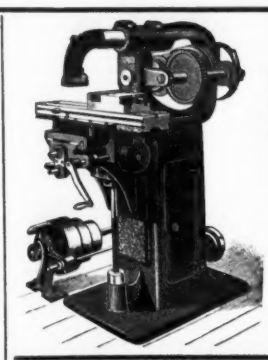

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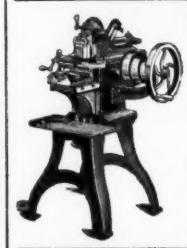

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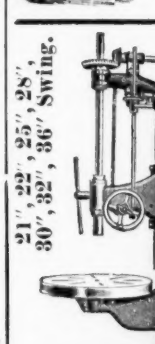

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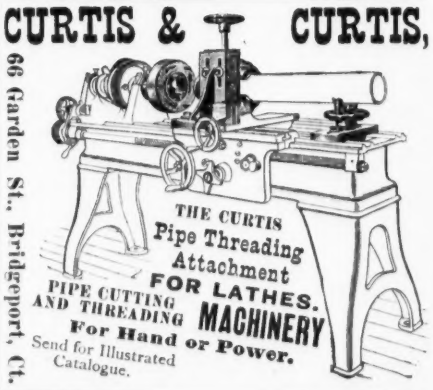

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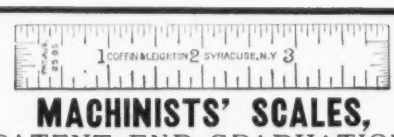

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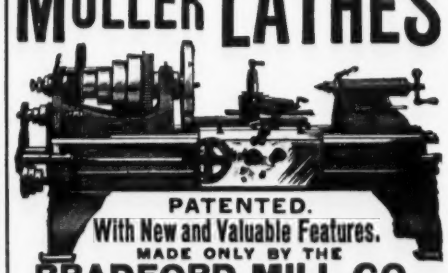

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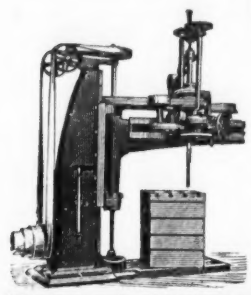

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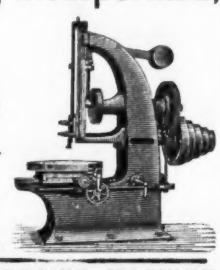

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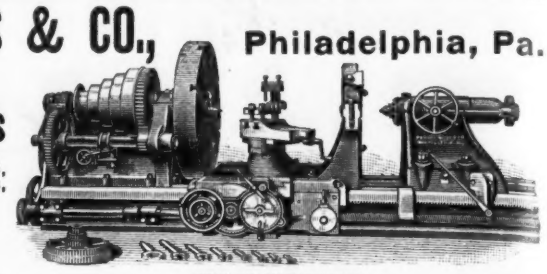

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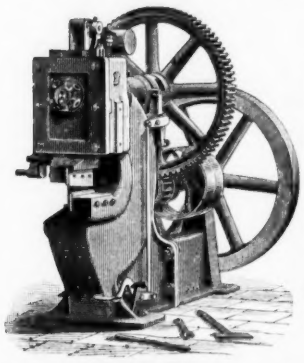

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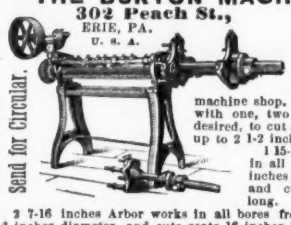

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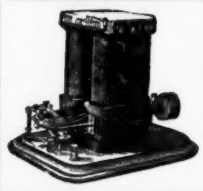

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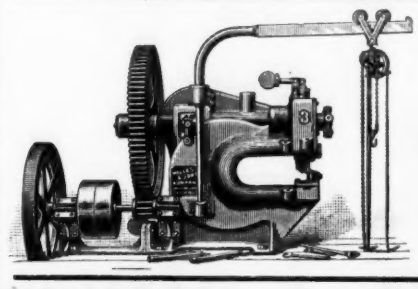

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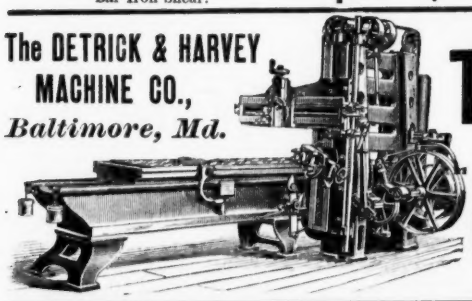

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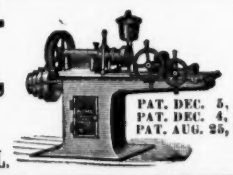

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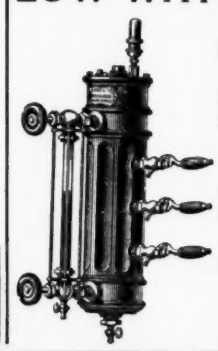

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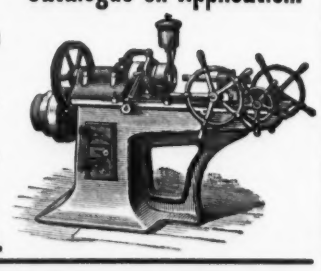

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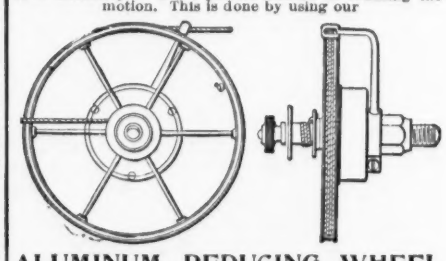

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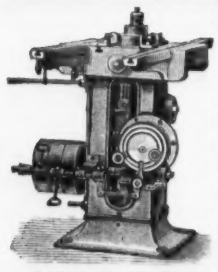

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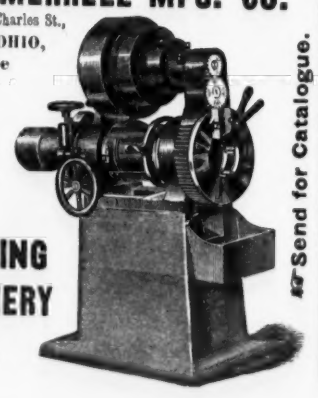

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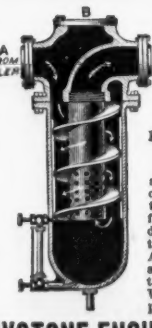

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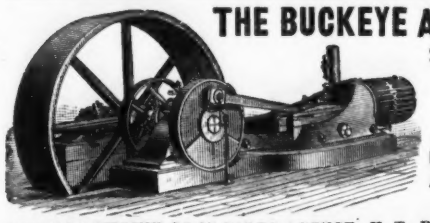

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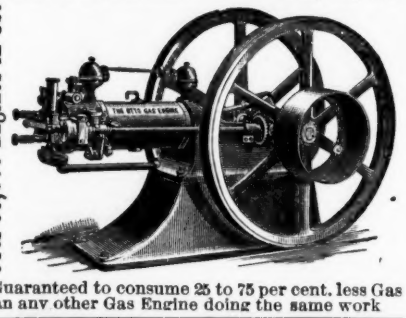

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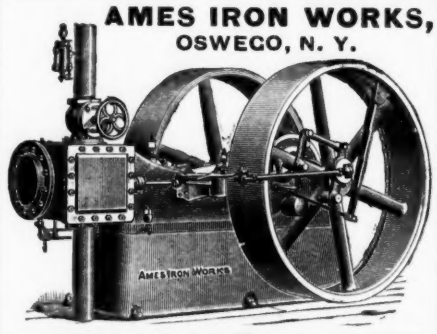

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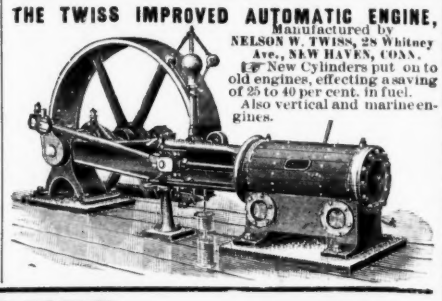

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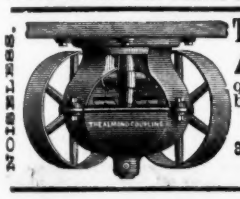

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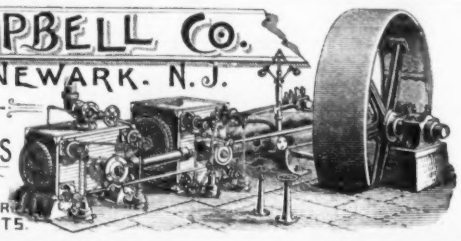

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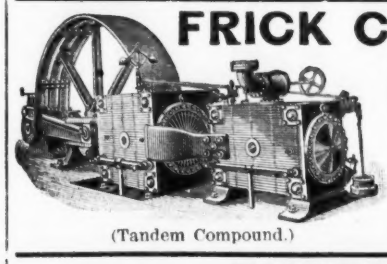

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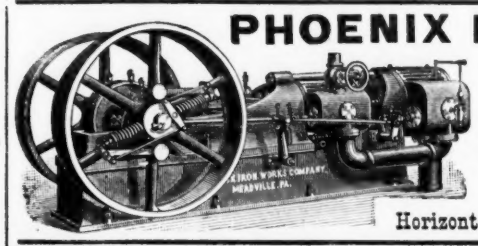

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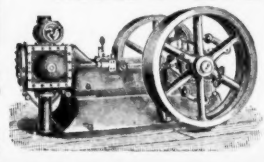

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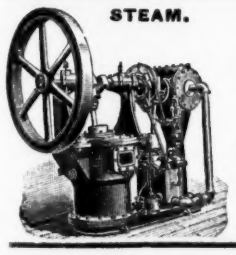

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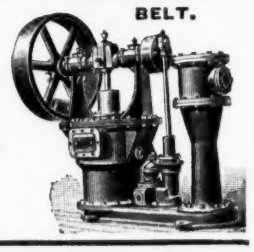

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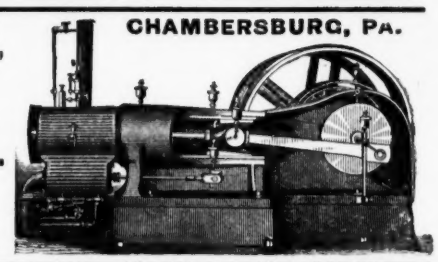

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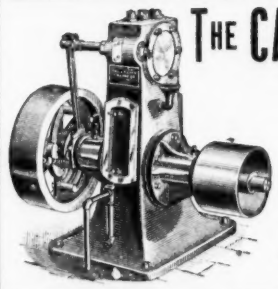

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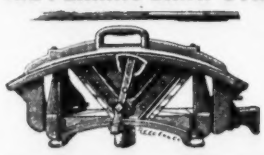

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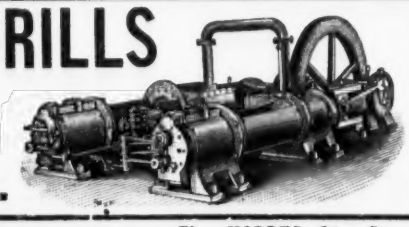

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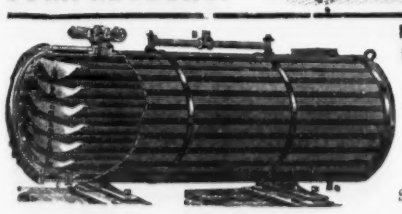

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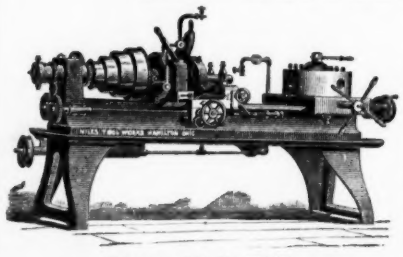

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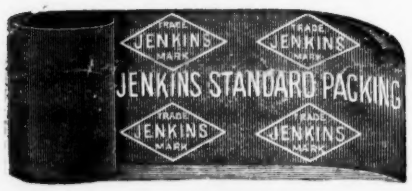

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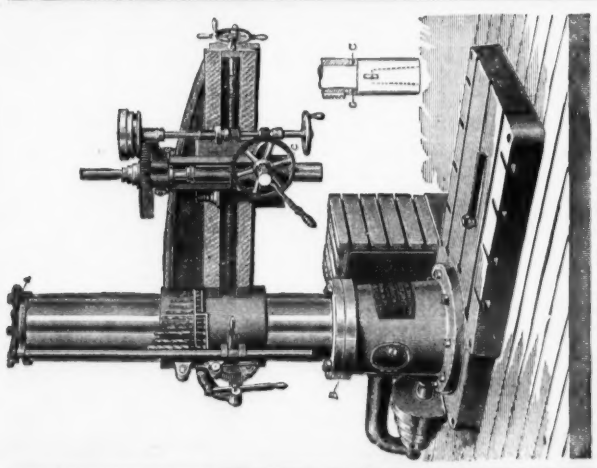

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N. J. R. R. Ave., Green & Bruen Sts., NEWARK, N. J.

SHAPER

Gives 50 to 100 per cent. MORE strokes per minute THAN ANY OTHER MAKE OF SHAPER NOW BUILT.

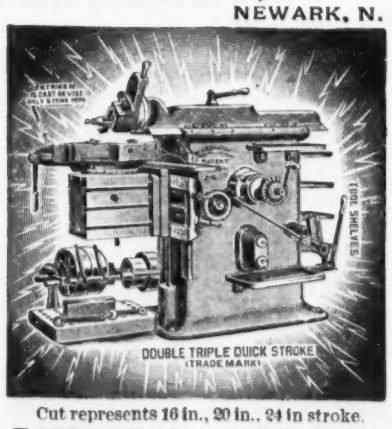
9 to 15 RICHARDS ST.,
BROOKLYN, N. Y., March 17, 1892.

GOULD & EBERHARDT, Newark, N. J.

Gentlemen: - We are obliged for your order No. 5130 which is forwarded to-day as per bill herein.

We always thought that the three Shapers we have of your former style were good machines, but are glad to say that the two recently purchased of the newer pattern are much superior to them. We like them better, for our work, than any other similar tool of which we know.

Yours truly, J. H. WILLIAMS & CO.



Cut represents 16 in., 20 in., 24 in stroke.

"DOUBLE TRIPLE QUICK" STROKE.

(TRADE MARK.)

The PRATT & WHITNEY CO., Hartford, Conn.

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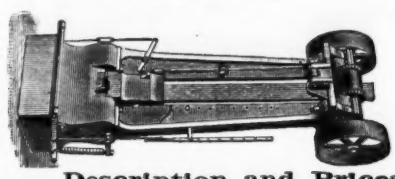

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C Clamps, in 5 Sizes, with Openings
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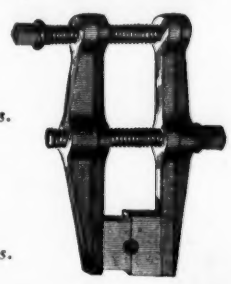

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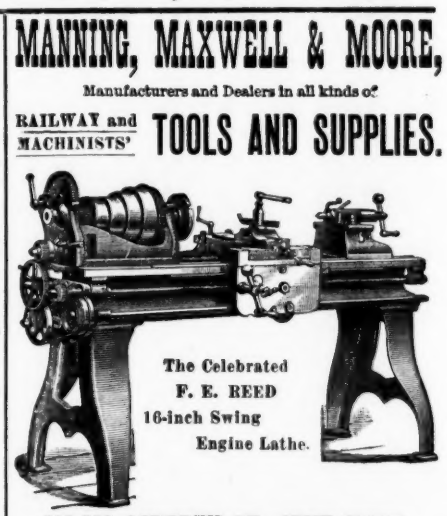

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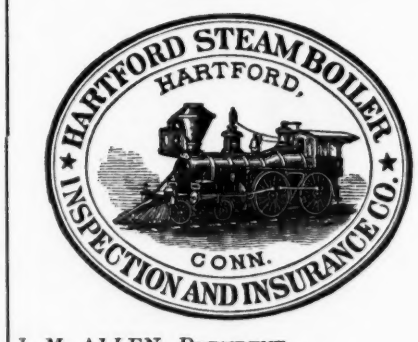

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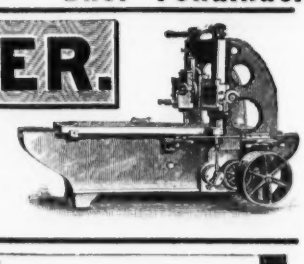

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